Scientific and Technical Aerospace Reports

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

JANUARY 23, 1967

VOLUME 5 • NUMBER 2

N67-11201—N67-12300

DOCUMENTS DEPT.

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Scientific and Technical Aerospace Reports, Volume 5, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Documentation Incorporated.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966

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- Scientific and technical reports of government agencies, universities, and research organizations throughout the world.

The first section of *STAR*, arranged in 34 categories, contains abstracts and bibliographic citations (see p. vi). A second section consists of five indexes: subject, author, corporate source, report/accession number, and accession/report number. Separate cumulative indexes are published quarterly, except for the fourth quarter, which is an annual index. Cumulative indexes also contain a contract number index.

Readers are encouraged to examine the abstracts in each category of interest. If time is short, and when interest is concentrated in specific areas, readers may which instead to scan source, author, and subject indexes. A more thorough coverage of a subject field may often be achieved by detailed examination of the subject listings, especially as they are cross-indexed in the quarterly indexes.

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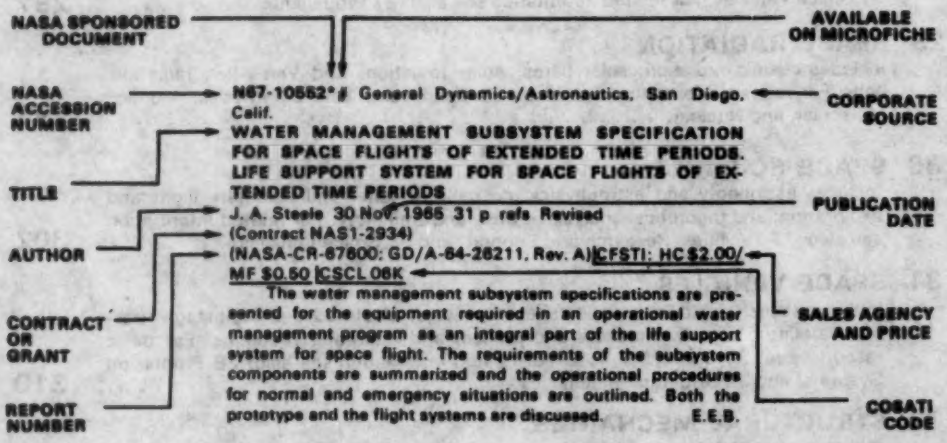
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N67-10552* # General Dynamics/Astronautics, San Diego, Calif.
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TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
J. A. Steele 30 Nov 1965 31 p refs Revised
AUTHOR
(Contract NAS1-2934)
(NASA-CR-67600; GD/A-64-28211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
CONTRACT OR GRANT
SALES AGENCY AND PRICE
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
REPORT NUMBER
COSATI CODE

VOLUME 5 NUMBER 2

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

January 23, 1967

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N67-11291# Naval Ordnance Lab., White Oak, Md.
MEASUREMENTS OF THE STATIC PRESSURE DISTRIBUTIONS AND SHOCK SHAPE ON AN OBLATE SPHEROID AT MACH NUMBERS OF 3 AND 6
Lionel Pasiuk 5 Jul. 1966 23 p ref
(NOLTR-66-138; Aerodynamics Res. Rept.-265) CFSTI: HC $1.00/MF $0.50

The results of experimental measurements of the static pressure distribution and bow shock shape on an oblate spheroid are presented. This experiment was conducted at nominal Mach numbers of 3 and 6 and a free stream Reynolds number range of 2,300,000 to 5,800,000 per foot. Comparisons are made with the calculated values of several different laboratories. Author (TAB)

N67-11345*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUMMARY OF NASA DATA RELATIVE TO EXTERNAL-STORE SEPARATION CHARACTERISTICS
Linwood W. Mc Kinney and Edward C. Polhamus Washington, NASA, Nov. 1966 21 p refs
(NASA-TN-D-3582) CFSTI: HC $1.00/MF $0.50 CSCL 01A

The available NACA AND NASA data relating to the carriage and separation characteristics of external stores are summarized, and some typical aerodynamic characteristics of stores in the carriage position are presented. Some of the subsonic interference origins and methods of combining experimental flow fields with theory to predict store forces and moments are illustrated by a comparison of calculated and measured store normal force and pitching moment. The effects of various combinations of speed, dive angle, airplane load factor, and store density on the separation characteristics are illustrated by using calculated store trajectories. The calculated store trajectories indicate that operational boundaries for safe store releases may be significantly affected by airplane speed, dive angle, and load factor. This paper includes a bibliography of NACA and NASA reports relative to the release of stores from airplanes. Author

N67-11354*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PRELIMINARY INVESTIGATION OF MODIFIED BLUNT 13° HALF-CONE RE-ENTRY CONFIGURATIONS AT SUBSONIC SPEEDS
George C. Kenyon and George G. Edwards Washington, NASA, Mar. 1961 47 p refs
(NASA-TM-X-501) CFSTI: HC $2.00/MF $0.50 CSCL 01A
(Declassified)

A wind-tunnel study was conducted to explore methods of modifying a blunt 13° half-cone to provide a reentry configuration with adequate performance and stability for horizontal landing. The basic 13° half-cone had a maximum lift-drag ratio of 1.7. The effects of modifying the aft portion of the blunt half-cone to improve performance, longitudinal stability, and trim characteristics were investigated. Also evaluated were the incremental effects on the longitudinal aerodynamic characteristics of vertical surfaces, several canopies, a retractable auxiliary lifting surface, control surfaces, and a landing gear. The results showed that the rear portion of a 13° blunt half-cone could be contoured to obtain very large increases in lift-drag ratio without large out-of-trim pitching moments. Vertical surfaces, a trailing-edge flap, and elevons all improved the lift-drag ratio. Neither a landing gear nor a canopy on the upper surface had any serious effects on performance or static longitudinal stability provided the canopy did not interfere with the leading-edge vortex system. Author

N67-11355*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE LATERAL AND DIRECTIONAL AERODYNAMIC CHARACTERISTICS OF A RE-ENTRY CONFIGURATION BASED ON A BLUNT 13° HALF CONE AT MACH NUMBERS TO 0.90
George C. Kenyon Washington, NASA, Nov. 1961 50 p refs
(NASA-TM-X-583) CFSTI: HC $2.00/MF $0.50 CSCL 01A
(Declassified)

The subsonic aerodynamic characteristics of a lifting body reentry configuration based on a 13° half cone were investigated in a wind tunnel. The lateral and directional characteristics are presented for Mach numbers from 0.25 to 0.90, including the effects of removing the canopy and the effects of adding dorsal and ventral fins. Tests at a Mach number of 0.25 were conducted at a Reynolds number of 15 million based on body length; tests at Mach numbers from 0.60 to 0.90 were conducted at a Reynolds number of 5 million. The test results are graphed, and indicate: (1) The basic reentry configuration was directionally stable at Mach numbers up to 0.70, but at higher Mach numbers it was directionally unstable for small angles of sideslip. (2) A dorsal fin provided directional stability characteristics, with only small increase in positive dihedral effect. A ventral fin was ineffective. (3) Removal of the canopy slightly improved the aerodynamic characteristics in pitch and yaw to sideslip angles of 6° N.E.N.

N67-11756# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
METHODS OF ANALYZING ATMOSPHERIC TURBULENCE [METHODS D'ANALYSE DE LA TURBULENCE ATMOSPHERIQUE]
Gerard Piazzoli 1966 18 p In FRENCH Presented at Colloq. on the Statist. Treatment of Meas., Grenoble, France, 26-29 Apr. 1966
(TP-346(1966)) CFSTI: HC $1.00/MF $0.50

For application to supersonic aircraft flights, the field of atmospheric turbulence is investigated. Taylor's hypothesis is used to assess the elastic deformations of the aerodynamic body. The two study methods proposed relate to the statistical and spectral knowledge of excitation sources, and the transfer function of bodies subjected to excitation in flight. Schematics show technical details on restitution of the vertical component on the turbulent field, double modulation multiplier, analogic measurements, and spectral density measurements. Transl. by R.U.

N67-11811*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HYPERSONIC AERODYNAMIC CHARACTERISTICS OF WING-BODY CONFIGURATIONS WITH CANARD CONTROLS

Lawrence E. Putnam and Cuyler W. Brooks, Jr. Washington, NASA, Dec. 1966 53 p refs

(NASA-TN-D-3728) CFSTI: HC $2.50/MF $0.50 CSCL 01A

An experimental investigation has been made in the Langley 15-inch hypersonic flow apparatus to determine the effects of wing vertical position, canard planform, canard size, and fuselage length on the effectiveness of canard controls on high-fineness-ratio configurations having a 45° swept-leading-edge trapezoidal wing. In addition, the effects of the canards on the lateral and directional characteristics of the configurations were determined. Some comparisons have been made with data from a previous investigation of configurations having a 70° swept delta wing to show the effects of wing planform on canard effectiveness. The results indicate that the high-wing configurations had lower lift coefficients and greater canard effectiveness than the low-wing configurations as a result of the interference of the canard wake and/or shock field with the flow over the high wing. The canard controls caused a small reduction in directional stability of both the high- and low-trapezoidal-wing configurations. Author

N67-11814*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EQUATIONS FOR THE APPLICATION OF WIND-TUNNEL WALL CORRECTIONS TO PITCHING MOMENTS CAUSED BY THE TAIL OF AN AIRCRAFT MODEL

Harry H. Heyson Washington, NASA, Nov. 1966 20 p refs

(NASA-TN-D-3738) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Equations are derived for the application of wall corrections to pitching moments due to the tail in two different manners. The first system requires only an alteration in the observed pitching moment; however, its application requires a knowledge of a number of quantities not measured in the usual wind-tunnel tests, as well as assumptions of incompressible flow, linear lift curves, and no stall. The second method requires a change in the tailplane incidence and, in general, a smaller change in the observed pitching moment. The latter system appears preferable even though it may require tests with several tailplane settings. In any event, the use of a separate tail balance is recommended whenever the corrections are expected to be large. Author

N67-11868# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

COMPUTATION OF THE AERODYNAMIC CHARACTERISTICS OF A WING-BODY COMBINATION IN A SUPERSONIC FLOW [CALCUL DES CARACTERISTIQUES AERODYNAMIQUES D'UN ENSEMBLE AILE-FUSELAGE EN ECOULEMENT SUPERSONIQUE]

Michel Enselme 1966 24 p refs In FRENCH; ENGLISH summary Presented at the 5th Congr. of the Intern. Council of the Aeron. Sci., London, 12–16 Sep. 1966

(TP-363(1966)) CFSTI: HC $1.00/MF $0.50

After a short survey of the supersonic aerodynamics problem of the wing-body interaction to be solved within the lifting surface theory, the principle of the proposed analogic method is described; a plane network made of inductances and capacitances gives an image of the partial derivatives equation where the analog of time is identified with the spatial variable taken along the speed, and the aerodynamic boundary conditions are transformed into the electric conditions imposed at the network bounderies. In view of developing the computation method and of checking its validity, a confrontation analog computer–wind tunnel has been made on a delta wing aircraft at various Mach numbers; the results of that study are presented. Author

N67-11920# France. Office National d'Etudes et de Recherches Aérospatiales, Chatillon-sous-Bagneux.

DYNAMIC STABILITY ON AIRPLANE MODELS BY THE FREE OSCILLATIONS METHOD [STABILITE DYNAMIQUE SUR MAQUETTES D'AVIONS PAR LA METHODE DES OSCILLATIONS LIBRES]

Xavier Vaucheret 1966 17 p refs In FRENCH Presented at the AGARD Meeting on Stability and Piloting, Cambridge, England, 20–23 Sep. 1966

(TP-390(1966)) CFSTI: HC $1.00/MF $0.50

A description is given of attempts to establish dynamic stability of aircraft models under transonic or supersonic flow. The experimental determination of the aerodynamic stability coefficients is shown, as are the excitation methods and the counting of transients obtained by free oscillations. A combination of a small number of good choices can result in these stability derivations. Transl. by M.W.R.

N67-11974# Weapons Research Establishment, Salisbury (Australia).

AN IBM 7090 SIX DEGREES OF FREEDOM RIGID BODY TRAJECTORY PROGRAM

P. L. Goodale Jun. 1966 44 p refs

(WRE-HSA-118) CFSTI: HC $2.00/MF $0.50

This note describes a rigid body six degrees of freedom trajectory program written to study the flight dynamics of a cruciform fin stabilised bomb having either a fixed or free spinning tail assembly. Disturbances to the bomb due to release from an aircraft, winds, and lateral pulse rockets can be taken into account. The mathematical formulation of the problem is presented together with a Fortran listing and a description of the input and output. Author

N67-11976# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.

DIRECT MEASUREMENT OF SHEAR FORCES IN AERODYNAMICS

Jean-Pierre Chevallier 1966 8 p refs Presented at the 2d Intern. Congr. on the Instrumentation of the Aerospatial Simulation, Stanford, Calif., 29–31 Aug. 1966; sponsored by IEEE

(TP-375(1966)) CFSTI: HC $1.00/MF $0.50

Direct measurement of the shear force in a fluid in motion along an element of wall is discussed. A pick-up, which has the sensitivity and the response time necessary to provide the direct measurement in conditions particular to the hot-shot wind tunnels, is described. The friction balance is examined, and it is concluded that direct skin-friction measurements can be carried out by means of the balance, which is simple enough to adapt to the various operational conditions. S.P.

N67-11988# Aeronautical Research Council (Gt. Brit.)

FURTHER TESTS WITH A VARIABLE RAMP INTAKE HAVING A DESIGN MACH NUMBER OF 2.2

M. C. Neale and P. S. Lamb London, HMSO, 1966 19 p refs Supersedes NGTE-NT-506–ARC-24599

(ARC-CP-826; NGTE-NT-506; ARC-24599) CFSTI: HC $1.00/MF $0.50

Results are reported of tests on a two-dimensional combined external/internal compression intake having a design Mach number of 2.2. The particular parameters investigated in the tests now reported are: (a) the design of the boundary layer bleed slot, (b) the terminal supersonic Mach number and (c) the free stream Reynolds number. The maximum pressure recovery obtained at the design Mach number was 88-1/2% with 3% bleed at a Reynolds number, based on free stream conditions and intake capture height, of 3.25×10^6. Author

N67-12031# General Electric Co., Philadelphia, Pa.
A HYPERSONIC WIND TUNNEL PROGRAM TO EVALUATE THE EFFECTS OF CENTER OF GRAVITY OFFSET ON THE ROLL DAMPING AND ROLL RATE ON THE STABILITY CHARACTERISTICS OF A SMALL ANGLE SPHERE CONE
Paul T. Gaskins Mar. 1966 16 p refs
(ATPR-5-66)

The objective of this test program is to determine the effect of c.g. offset on roll damping and roll rate on the stability coefficients of a small angle sphere cone. A secondary objective of the test will be to determine the qualitative effect of mass addition, plus roll rate, on these same stability parameters. The tests are to be conducted at Mach numbers 8 and 10 in a 16x16 in. hypersonic wind tunnel. Data will be obtained for C_m, C_N, C_Y, and C_{lp} for roll rates between zero and 5000 rpm. The test configuration will be a 7°15° half angle sphere cone with a nose bluntness of .075. The angle of attack will be varied between zero and 12 degrees. Author

N67-12096*# General Electric Co., Lynn, Mass. Advanced Technology and Demonstrator Programs Dept.
EXPERIMENTAL EVALUATION OF OUTER CASE BLOWING OR BLEEDING OF SINGLE STAGE AXIAL FLOW COMPRESSOR. PART I: DESIGN OF ROTOR AND BLEEDING AND BLOWING CONFIGURATIONS
R. G. Griffin and L. H. Smith, Jr. 20 Apr. 1966 48 p refs
(Contract NAS3-7618)
(NASA-CR-54567; GE-R66FPD137) CFSTI: HC $2.00/MF $0.50
CSCL 01A

An axial-flow high-aspect-ratio transonic compressor rotor blade row was designed as a research unit for use in an experimental program to study the effect of case bleed and case blowing at the rotor blade tip on compressor performance and operating range. Three casing bleed and three casing blowing configurations were designed with sufficient capacity to enable the injection or extraction of 4% of the compressor design flow. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N67-11729*# Wyle Labs., Inc., Huntsville, Ala. Testing Labs.
THE STABILITY OF CAPTIVE BALLOONS FOR INSTRUMENT FLYING, INCLUDING ANALYSIS OF MULTI-CABLE CONFIGURATIONS
R. C. Potter Nov. 1965 102 p refs
(Contract NAS8-5384)
(NASA-CR-79508; WR-65-28) CFSTI: HC $4.00/MF $0.75
CSCL 01C

A simple single balloon cable is analyzed and the resultant relationships are applied to solve various multicable configurations. The effect of the aerodynamic drag of the cable on the basic stability of the system is shown to be small, and thus can generally be neglected. Several examples of two cable systems are examined with the assumption of no aerodynamic lift of the balloon. An approximate solution for a single balloon on two cables, with aerodynamic lift of the balloon, is also derived using a computer. The results are used to derive the basic design parameters of the cable configuration for a stable multicable system. An Appendix gives details of the computer programs. The actual balloon system used by NASA to measure the acoustic field of rocket engines is considered. The optimum configuration is found, and the flying characteristics of the system are calculated. Author

N67-11747# Aeronautical Research Council (Gt. Brit.)
HANDLING QUALITIES OF AIRCRAFT WITH MARGINAL LONGITUDINAL STABILITY
T. B. Saunders London, HMSO, 1966 58 p refs Supersedes ARC 25796
(ARC-CP-837; ARC-25796) CFSTI: HC $3.00/MF $0.50

The problem of assessing the handling qualities of aircraft with marginal or negative longitudinal stability is investigated. A mathematical model of the human pilot is used to study closed loop tracking and the results are checked by an experiment in a fixed base simulator. Some of the older handling qualities criteria such as manouver margin and stick force per g are of limited use at marginal levels of stability, but plots of pilot opinion contours against the stiffness and damping term of a second order system are useful provided the correct pair of dominant roots is chosen. However, where either root of the other pair has a time to double amplitude less than 3-5 sec the rating from the dominant pair may be modified by consideration of multiloop control of pitch angle, speed, and height. At present this can be done reliably only be testing the particular case in a flight simulator. Those facts are used as the basis of a procedure which can be used for assessing the longitudinal handling qualities of aircraft even when these have marginal stability. Disagreement between theoretical predictions and simulator results leads to the hypothesis that the necessity to apply phase lag has little effect on pilot opinion. Author

N67-11750# McDonnell Aircraft Corp., St. Louis, Mo.
HANDLING QUALITIES OF HIGHLY SWEPT WING AIRCRAFT
Chester W. Miller [1966] 21 p Presented at the Flight Mech. Panel Meeting of AGARD, Paris, 10-11 May 1966

This paper examines some of the fundamental handling qualities of the highly swept wing aircraft and discusses some of the experience obtained in overcoming and minimizing the problem areas: first, considering briefly why the swept wing is being used; second, the foremost handling qualities associated with the highly swept wing; and third, some of the developmental experience in solving the handling quality problem problems of the highly swept wing. Author

N67-11837# Federal Aviation Agency, Washington, D. C. Office of Aviation Medicine.
THE "STALL BARRIER" AS A NEW PREVENTIVE IN GENERAL AVIATION ACCIDENTS
C. W. Von Rosenberg, F. R. Kean, and Stanley R. Mohler Sep. 1966 6 p refs
(AM-66-31)

An elementary device, actuated by the conventional stall warning vane is described which can be inexpensively installed in any aircraft. The new device, the Stall Barrier, will prevent stalls through (1) warning the pilot through the touch sense of the impending stall, and (2) taking corrective action for the pilot. Short-field take-offs, slow flight, and short-field landings, can all be accomplished safely with this device at absolute minimum speeds. Author

N67-11866# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany).
LOW-FREQUENCY NOISE GENERATOR FOR GENERATING RANDOM NOISE [TIEFFREQUENTER RAUSCHGENERATOR ZUR ERZEUGUNG VON STOCHASTISCHEN STOERGROESSEN]
A. Schreier and W. Raspe Apr. 1966 19 p refs In GERMAN; ENGLISH summary
(DLR-Mitt.-66-08) CFSTI: HC $1.00/MF $0.50

For the investigation of the dynamic behavior of an aircraft with airborne autopilot employing statistical methods, random noise shall be put on the elevator. Noise is generated by means of a transistorized noise generator developed for this purpose with a frequency range of 0 to 10 cps. The apparature uses a noise diode as a noise source, an amplifier, and a ring modulator with low-pass filter for a frequency transformation to the required low-frequency range. In this paper, development, structure, and characteristics of the noise generator are described. Author

N67-11872# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
SOME AERODYNAMICAL ASPECTS OF THE VARIABLE SWEEP AIRPLANE [QUELQUES ASPECTS AERODYNAMIQUES DE L'AVION A FLECHE VARIABLE]
Philippe Poisson-Quinton and Michel Enselme 1966 25 p refs In FRENCH Presented at the 1966 Session of the Tech. Maritime and Aeron. Assoc., Paris, 2–6 May 1966
(TP-353(1966)) CFSTI: HC $1.00/MF $0.50

A configuration modification in the leading edge wing flap is proposed for supersonic-type aircraft. Emphasis is placed on the aerodynamic characteristics of the camber arch in variable swept wings to prevent stalling. An application to the Boeing 733 supersonic transport is mentioned. Transl. by R.Li.

N67-11876# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany).
COMPARISON OF RESULTS OBTAINED FOR FREQUENCY RESPONSE FUNCTIONS FOR AIRCRAFT TYPE DO 27 BY STATISTICAL AND CLASSICAL METHODS [VERGLEICHE DER ERGEBNISSE FUER FREQUENZAENGE EINES FLUGZEUGS DO 27 NACH STATISTISCHEN UND KLASSISCHEN VERFAHREN]
K. Ernst and R. Koehler Jul. 1966 29 p refs In GERMAN; ENGLISH summary
(DLR-FB-66-50) CFSTI: HC $2.00/MF $0.50

For the determination of frequency response functions connecting elevator and pitch angle of the aircraft type Do 27, the elevator was moved in flight by a noise generator. From the random variations of the elevator and the pitch angle, the frequency response functions were determined by means of the random process theory and compared with the results obtained with harmonic oscillations. Author

N67-12024# McDonnell Aircraft Corp., St. Louis, Mo.
TECHNICAL AND ECONOMIC EVALUATION OF AIRCRAFT FOR INTERCITY SHORT-HAUL TRANSPORTATION, VOLUME III Final Report
St. Louis, Mo., McDonnell Aircraft Corp., Apr. 1966 174 p
(Contract FA65-WA-1248)
(E390; FAA-ADA-74)

Appendices are presented for a technical and economic evaluation of the potential airline use of STOL/VTOL aircraft to serve intercity short haul travelers. The appendices contain detailed data covering the study of aircraft design group weights, mission summaries, and STOL/VTOL port taxi times; as well as parametric data for use in determining optimum STOL and VTOL terminal characteristics and the associated cost of establishing specific terminal systems. Also included is information on a noise evaluation, additional operating costs, STOL/VTOL intercity penetration computer programs, California corridor airline systems evaluations, and STOL/VTOL impact on the urban scene. R.N.A.

N67-12034# Federal Aviation Agency, Oklahoma City, Okla.
FLOTATION CHARACTERISTICS OF AIRCRAFT-PASSENGER SEAT CUSHIONS
Ernest B. Mc Fadden and James M. Simpson Apr. 1966 17 p refs
(AM-66-13)

Flotation characteristics of aircraft seat cushions were evaluated with respect to their utilization as individual flotation devices. The Federal Aviation Agency Technical Standard Order C-72 states that individual flotation devices shall provide a minimum of 14 pounds of buoyancy for a period of 8 hours. When statically tested with an inanimate mass, initial prototype cushions successfully met and exceeded this requirement. When dynamically evaluated by human subjects in moderate wave action, these prototypes failed in 8 minutes. These cushions therefore met the provisions of the Technical Standard Order as written but did not meet the intent. Progressive development has resulted in a number of seat-cushion designs utilizing a variety of techniques to provide adequate survivor flotation. Prototypes of these seat cushions were subjected to dynamic and more realistic evaluation by human subjects both in the field and laboratory. A comparison of mechanical- and human-subject evaluations is included. Survivor body-flotation attitude and seat-cushion retention devices are also discussed. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N67-11310# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PERSPECTIVES OF CREATING POWERFUL MAGNETO-HYDRODYNAMIC GENERATORS
Ye. Ya. Kazovskiy, Ya. B. Danilevich, and V. N. Shakhtarin 17 Jun. 1966 27 p refs Transl. into ENGLISH from Electrotekhnika (USSR) no. 9, 1964 p 8–14
(FTD-TT-65-1876; TT-66-62350; AD-639488) CFSTI: HC $2.00/MF $0.50

The basic problems connected with the creation and utilization of an MGD generator are discussed. Further analyzed are the possibilities of increasing the effectiveness of MGD generators on account of cold ionization methods by using ultra-conductors. (Author) TAB

N67-11332*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIENCE IN INVESTIGATION OF COMPONENTS OF ALKALI-METAL-VAPOR SPACE POWER SYSTEMS
Robert E. English and Ruth N. Weltmann Washington, NASA, 1966 22 p refs Presented at the Symp. on Alkali Metal Coolants–Corrosion Studies and System Operating Experience, Vienna, 28 Nov.–2 Dec. 1966; sponsored by Intern. Atomic Energy Agency
(NASA-TM-X-52249) CFSTI: HC $1.00/MF $0.50 CSCL 10B

As a preliminary to development of a reactor-powered alkali metal-vapor turbogenerator power system for use in space, components of such a system have been studied and operated in various alkali metal loops. The observed performance of the components and the experience in operation of the loops are both described. Heat transfer to boiling potassium was investigated in a 300 kW loop of L-605 for temperatures as high as 1750° F and in a 150 kW loop of Cb-1Zr for temperatures as high as 2100° F. In addition, heat transfer to boiling sodium was investigated in a 500 kW bimetallic loop of Cb-1Zr and 316 stainless steel; the boiling temperature reached 2000° F. Condensation of potassium at temperatures of 1200°–1500° F was investigated in two loops

of 50 and 150 kW capacity. Wet potassium vapor at 1500° F was produced by a 3 MW gas-fired boiler and supplied to a 2-stage turbine; although the entire loop was built of 316 stainless steel, the turbine rotor blades were of TZC, TZM, and Udimet 700 for purposes of comparison of erosion resistance. Condition of the turbine at the end of an endurace run of 5000 hours is described. Author

N67-11333*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF HIGH SPEED FLUERIC LOGIC CIRCUITRY FOR A NOVEL PNEUMATIC STEPPING MOTOR
William S. Griffin and William C. Cooley Washington, NASA, 1966 38 p refs To be presented at the Symp. on Fluidics, Lafayette, Ind., 8–10 May 1967; sponsored by Am. Soc. of Mech. Engr. and HDL
(NASA-TM-X-52250) CFSTI: HC $2.00/MF $0.50 CSCL 13G

Under a program aimed at nuclear rocket control drum actuator improvement, a novel, pneumatic stepping motor has been developed. This paper describes improved, high speed flueric logic circuitry to drive the motor, the breadboard performance of the logic circuitry-stepping motor system; and finally compares the pneumatic stepping motor actuation system with the more conventional pneumatic piston-in-cylinder actuator. Author

N67-11338*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VORTEX VALVE PERFORMANCE POWER INDEX
Vernon D. Gebben Washington, NASA, 1966 20 p refs To be presented at the Symp. on Fluidics, Lafayette, Ind., 8–10 May 1967; sponsored by Am. Soc. of Mech. Engr. and HDL
(NASA-TM-X-52257) CFSTI: HC $1.00/MF $0.50 CSCL 13G

The pressure, flow, and power characteristics of a vortex valve are altered by changing the geometry of the unit. An index was developed for evaluating changes in the power consumption. This index is considered to be an important parameter which should be examined during the design of an optimized vortex valve. The power index is determined by the ratio of the maximum radial inlet power to the tangential inlet power required to stop the radial inlet flow. Characteristics and applications for the power index are illustrated by results from an experimental investigation. Author

N67-11393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME FACTORS TO CONSIDER IN DETERMINING THE CAPACITY OF A NICKEL CADMIUM CELL
G. Halpert Aug. 1966 9 p
(NASA-TM-X-55610; X-735-66-275) CFSTI: HC $1.00/MF $0.50 CSCL 10C

Tests performed to ascertain the effect of immediate prior history of a sealed nickel–cadmium cell on the charging capacity of that cell are reported. A series of experiments are described in which cell types of cells were discharged to 1.0 volt, then discharged further (drained or essentially short circuited) through a 1.0 ohm resistor for varying intervals prior to the capacity test. The experimental results indicated that there was a significant difference in capacity between those cells which were drained for more than 16 hours and those which were drained for short periods of 3 hours or not at all. Tests proved conclusively that the capacity of a sealed nickel–cadmium cell is dependent on the treatment given it prior to the capacity test cycle. S.P.

N67-11722*# Atomics International, Canoga Park, Calif.
RADIATION EFFECTS ON SILVER AND ZINC BATTERY ELECTRODES V Interim Report, Apr.–Jul. 1966
M. M. Nicholson, H. L. Recht, and R. E. Kelchner 14 Oct. 1966 26 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951109)
(NASA-CR-79489; AI-66-186) CFSTI: HC $2.00/MF $0.50 CSCL 10

The investigation of gamma radiation effects on silver electrodes at 60% and 30% states of charge was continued. Net capacity increases averaging 5% have been observed during irradiations at the 60% level with a total dose of 7×10^7 rads (H_2O). At 30% net losses of 4% and 15% were found in the two runs, respectively. It appears that the losses at 30% may be significant, while the changes at 60% are essentially within the uncertainty of the measurements. Hydrogen was again evolved during the irradiation of silver-cadmium cells. In one run two silver electrodes were cycled one against the other in the absence of cadmium. Hydrogen and oxygen were then produced in a mole ratio of 1.7:1. Work with zinc electrodes was concentrated on a reproducible procedure for determination of discharge capacity. This was partially accomplished by the use of cellophane-wrapped zinc electrodes in starved-electrolyte cells. With that construction, the capacity will offer at least a semiquantitative criterion for the evaluation of radiation effects. Author

N67-11732*# Atomics International, Canoga Park, Calif.
EFFECTS OF HIGH-ENERGY PROTONS ON SELECTED CELLS Final Report, Jun. 1966–Aug. 1966
M. M. Nicholson, H. L. Recht, and R. E. Kelchner Aug. 1966 26 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951648)
(NASA-CR-79535; AI-66-149) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Experimental silver-cadmium and nickel-cadmium cells containing commercial battery electrodes and aqueous potassium hydroxide electrolytes were exposed to 60 and 137 Mev protons. Total integrated proton fluxes were twice the maximum values anticipated from solar flare activity during travel to Venus in 1967–69. Irradiated and control cells were examined for gas evolution, loss of electrode materials, and changes in discharge capacity. With the exception of low-level, rapidly-decaying radioactivity, no proton effects were detectable. Author

N67-11822*# TRW, Inc., Cleveland, Ohio.
ELECTROLYSIS CELL FOR ORBITAL TEST
C. W. Fetheroff, R. G. Husbacher, D. L. De Respiris, J. G. De Steese, and G. L. Mrava Washington, NASA, Nov. 1966 68 p ref
(Contract NASW-998)
(NASA-CR-648) CFSTI: HC $2.50/MF $0.75 CSCL 06K

Detailed studies were made of the processes occurring at the electrodes of compact water electrolysis cells under varying conditions of operation. Based on these studies, two identical water electrolysis subsystems, including complete analytical instrumentation and a water supply for 24 hour's operation, were designed and fabricated. The wick-vapor-feed concept, requiring no dynamic components, was utilized. Each of the two flight packages weighs 14.5 lb. During the performance acceptance test an average voltage of approximately 1.65 volts per cell at a current density of 100 amperes/square ft was obtained at an average cell temperature of approximately 93°F. The two units were delivered for additional laboratory testing prior to an orbital test to determine the effects of gravity-free operation on water electrolysis subsystem performance. Author

N67-11843*# Electro-Optical Systems, Inc., Pasadena, Calif.
HIGH-PERFORMANCE THERMIONIC CONVERTERS Final Report, 19 May 1965–19 Jul. 1966

A. E. Campbell 2 Sep. 1966 181 p refs Prepared for JPL (Contracts NAS7-100; JPL-951225)
(NASA-CR-79388; EOS-6952-Final) CFSTI: HC $5.00/MF $1.00 CSCL 20L

Precision variable parameter test vehicles were designed and constructed in order to conduct parametric investigations of plane-parallel cesium vapor thermionic converter performance characteristics. The vehicles fabricated were capable of operating with emitter temperatures from 1300° to 2100°K, collector temperatures from 700° to 1300°K, and cesium reservoir temperatures from 400° to 750°K. The interelectrode spacings could be varied from less than 0.0002 inch to over 0.015 inch and were accurately reproducable. Two sets of electrode materials were studied: the rhenium emitter/rhenium collector, and rhenium emitter/ molybdenum collector. High performance plane parallel converters were also designed, fabricated, and tested. Several experiments on fabrication technology were performed, including the formulation of electron beam welding schedules, thermal cycling of active alloy brazed metal-to-ceramic seals, heat transfer and thermal emittance measurements for radiator design, and a thermal mockup of a thermionic converter to ascertain the effect of thermal loads on interelectrode spacing. M.G.J.

N67-11948*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERAL METHOD FOR PREDICTING EFFICIENCY OF PARABOLOIDAL SOLAR COLLECTOR
Gabriel N. Kaykaty Washington, NASA, Dec. 1966 38 p refs
(NASA-TM-X-1323) CFSTI: HC $2.00/MF $0.50 CSCL 10B

A technique and working curves are presented for the rapid calculation of the maximum collection efficiency of a paraboloidal collector that focuses solar energy into a cavity receiver. Effects of collector surface errors, orientation error, and rim angle are included. Any distribution of surface errors may be specified in the method. Results of a comparison between this technique and a rigorous analysis for a collector with a normal distribution of surface error demonstrate that the two methods of calculation predict essentially the same maximum collection efficiency in the absence of orientation error. When the system is misoriented, the maximum collection efficiency is 1 percentage point lower than the refined calculation for the range of misorientation up to 30 minutes at a receiver operating temperature of 2200°R and less than 1.5 percentage points lower at a receiver operating temperature of 4000°R. The favorable agreement in the compared values of collection efficiencies indicates that the presented technique is sufficiently accurate for use in solar-power-systems analysis. Author

N67-12043*# Battelle Memorial Inst., Columbus, Ohio.
THERMAL-ENERGY-STORAGE SUPPORTING RESEARCH Final Technical Report, Apr. 1, 1965–Sep. 30, 1966
D. P. Mosk, comp. 30 Sep. 1966 300 p refs
(Contracts NAS7-100; JPL-950978)
(NASA-CR-80058) CFSTI: HC $6.00/MF $1.50 CSCL 10B

Critical property data were determined on several potential thermal-energy-storage (TES) materials to provide information necessary for design of TES-thermionic systems for application in long duration space flights. The primary objective was stated as the evaluation of 3BeO–2MgO and 4BeO–MgO–Al_2O_3 for use as TES materials by determining selected thermophysical properties. The materials were evaluated by determining liquid and solid thermal-expansion characteristics, liquid and solid thermal conductivity, enthalpy and heat of fusion, and compositional stability. Compatibility testing was conducted to support the specimen preparation effort and to provide assurance that environmental effects will not influence the property data. Programs were also conducted to define equilibrium phase diagrams, to determine the emittance and absorptance of potential container materials, and to provide a mathematical model for heat-transfer analysis of a TES-thermionic device. Extensive details are also given on the test program and materials support. L.E.W.

N67-12079*# Bendix Corp., Southfield, Mich. Research Labs. Div.
HYDRAULIC FLUID INTERACTION SERVOVALVES Monthly Technical Report, 1 Feb.–1 Mar. 1966
A. Blatter 1 Mar. 1966 24 p
(Contract NAS8-11928)
(NASA-CR-79761; Rept.-3371) CFSTI: HC $1.00/MF $0.50 CSCL 13G

Continuing research in the development of a hydraulic servovalve, utilizing a vortex valve fluid state device as the primary flow control element, is briefly summarized. Details are given on servovalve design, torque motor specification, servovalve environmental tests, and vortex valve tests. The torque motor output force and stroke incompatibility was resolved by increasing the flapper length and stroke approximately 20%. Future plans are outlined, and a program schedule, financial and manpower report, and torque motor force requirements are also included. L.E.W.

N67-12102*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMIONIC CONVERTER AND GENERATOR DEVELOPMENT
P. Rouklove *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 1–14 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Development efforts on the solar energy thermionic (SET) program are detailed, and the evaluation of a four-converter thermionic generator (JG-3) is described. Figures are presented to show the four-converter generator, and its thermal analysis; tabulated data on its characteristics are included. The equipment used to test the generator is described, and test data on the generator are given. The problems involved in the individual optimization of the performance of thermionic converters by adjusting the cesium pressure during space operations are assessed. Two approaches were considered: an active control consisting of a thermal sensor, an electronic network, and a reservoir heater; and a passive control composed of vane-type radiation shields mechanically actuated to control the thermal energy radiated from the reservoir surface. Results indicate that the passive control device was disappointing; the operation was erratic, large temperature variations were required before any motion was observed, and the prototype as constructed probably lacked strength to pass normal environmental requirements. M.G.J.

N67-12118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIQUID MHD POWER CONVERSION
D. G. Elliott, D. J. Carini, and L. G. Hays *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 63–72 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A liquid-metal magnetohydrodynamic (MHD) system, which has no rotating parts, is investigated for use in long-lived electric propulsion power plants. Tests were conducted on a compensated ac MHD generator with successful conversion of NaK pressure-drop energy to net ac electric power output on a self-excited basis. Both empty channel and flow tests were conducted; and for the former 19 successive wave positons are shown that represent the travel of the field over one-fourth the length of the generator. Measured efficiencies during flow tests were compared with ideal values; and with full power of 5 kw, overall efficiency of the generator is expected to be about 15%. Excitation of the compensating poles had no effect on the efficiency within the ±20% uncertainty of the low current tests conducted. A 100-hr, 2000°F lithium erosion test was completed, and the measured performance of a helical induction pump proved satisfactory. Of the

erosion specimens the Nb–1%Zr wedge suffered the least material loss and was relatively unaffected by the flowing lithium. M.W.R.

N67-12169*# Thermo Electron Engineering Corp., Waltham, Mass.
SOLAR THERMIONIC GENERATOR DEVELOPMENT Quarterly Report, 1 Jun.–3 Sep. 1966
Sep. 1966 50 p Prepared for JPL
(Contracts NAS7-100; JPL-951263)
(NASA-CR-80135; TE-20-67; QR-3) CFSTI: HC $2.00/MF $0.50 CSCL 10B

The third and fourth thermionic converter engineering models, T-2038 and T-204, were fabricated and tested. Both converters exhibited substantially better performance than the previous models. Converter T-204 was able to deliver an output of 29 amperes at 1.0 volt at 1724°C hohlraum temperature and in steady state, in spite of the lowered emitter temperature of 1961°K caused by the higher thermal resistance of a solid rhenium emitter. The fabrication of T-204 included the test of an all-rhenium emitter structure which was successfully cycled through 10 fast thermal cycles to 1780°C at the hohlraum. Furthermore, chromium carbide and zirconium carbide were evaluated as possible alternate radiator coatings to chromium oxide, but both materials were found to have only 60% of the emissivity of chromium oxide. Author

N67-12175*# Brigham Young Univ., Provo, Utah. Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE Quarterly Report
E. A. Butler, and A. U. Blackham 9 Jul. 1966 20 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951554)
(NASA-CR-80126; QR-1) CFSTI: HC $1.00/MF $0.50 CSCL 10C

A device has been constructed to permit the measurement and recording of the difference in potential (ΔE) at two points on a working silver electrode while simultaneously measuring the potential of the electrode relative to a reference electrode. Plots are presented which show how ΔE varies with the state of charge of the electrode and with current density. Silver surfaces have been prepared both on glass and on silver foil by evaporation-deposition of silver. These surfaces show promise as the base for surface area estimation. Gas chromatographic analysis of the products from pyrolysis of commercial sintered silver electrodes at temperatures up to 750°C indicates CO_2, CH_4, C_2H_4, and possibly other components. Infrared analysis of the fractions verified the CH_4 and C_2H_4. Author

N67-12215*# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
NONDISSIPATIVE SOLAR ARRAY OPTIMUM CHARGE REGULATOR Final Report
Jul. 1966 96 p
(Contract NAS5-9210)
(NASA-CR-79093; P66-181) CFSTI: HC $3.00/MF $0.75 CSCL 10B

Complete testing of the 50-watt and 250-watt regulators indicated stability of operation over all of the extremes of input/output conditions and environment. Noise immunity of both regulators was observed to be very high and switching loads on their outputs had no effect on operation. Power transfer efficiency of the breadboard models was somewhat less than desired. For the 50-watt regulator, the 80-percent efficiency goal could be met by proceeding with the proposed improvements as described in Section 4.2. In the case of the 250-watt regulator, losses in the switching choke were found to be the prime contributor in causing the efficiency to fall below the goal of 90 percent. Comparison of actual circuit operation with the theoretical model indicated close correlation between the measured operating parameters and those calculated from the design equations. The battery study indicated that a-c charging currents had very little or no effect upon battery efficiency. Author

N67-12244*# Borden Chemical Co., Philadelphia, Pa. Central Research Lab.
IMPROVED SEPARATORS FOR SILVER OXIDE-ZINC AND SILVER OXIDE-CADMIUM CELLS FOR SPACECRAFT APPLICATION Final Report, Nov. 19, 1964–Nov. 19, 1965
Helmuth L. Pfluger and Howard E. Hoyt 10 Nov. 1965 60 p refs
(Contract NAS5-9107)
(NASA-CR-80108) CFSTI: HC $3.00/MF $0.75 CSCL 10C

Studies to improve the properties of membranes in silver oxide-zinc, and silver oxide-cadmium batteries are reported. The types of membranes or separators developed were studied in greater detail with particular emphasis on their permeability to and reaction with silver ions. Further modifications of methyl cellulose formulation were aimed at increased conductivity of electrolyte-swollen films, particularly desirable when the swelling electrolyte is potassium hydroxide in concentrations greater than 30%. Synthesis of new polymers was undertaken to explore the possibility of combining within the same molecule the balance of polarity needed for efficient separator performance. R.U.

N67-12298# Case Inst. of Tech., Cleveland, Ohio.
FLUERICS (FLUID AMPLIFICATION). 18: A FLUID-STATE DIGITAL CONTROL SYSTEM
Ralph O. Turnquist (Ph.D. Thesis) Washington, D. C., HDL 2 Feb. 1966 66 p refs
(Contract DA-49-186-AMC-79(D))
(AD-633689) CFSTI: HC $3.00/MF $0.75

The design and development of a digital-to-analog (D/A) converter suitable for use in fluid-state digital control systems are described. Design considerations are discussed, and theoretical static and dynamic analysis are presented. Experimental static and dynamic test results are also included. The design of input data handling techniques suitable for fluid-state digital control systems is described. These techniques include a counter preset device for applying step inputs and a synchronizer necessary when applying ramp inputs. Models of both devices performed satisfactorily. The D/A converter and input data handling devices were combined with an existing quantizer, bidirectional counter, preamplifier, power amplifier, and prime mover to form a prototype digital pulse-data control system. An analysis of the effect of system parameters on performance is presented. Experimental test results are also included. A relatively simple digital lead compensation scheme was implemented. Experimental test results showed that this type of compensation can be used effectively to stabilize fluid-state digital control systems. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N67-11262# Director of Engineering and Industrial Services, Edgewood Arsenal, Md. Biophysics Lab.
MORPHOLOGICAL AND BIOCHEMICAL EFFECTS OF CLOSTRIDIUM PERFRINGENS ALPHA TOXIN ON INTACT AND ISOLATED SKELETAL-MUSCLE MITOCHONDRIA Technical Report, Aug. 1965–Apr. 1966

I. William Grossman, Dale H. Heitkamp, and Bertram Sacktor Sep. 1966 19 p refs
(EATR-4028; AD-638788) CFSTI: HC$1.00/MF$0.50

Electron-dense deposits were observed in skeletal-muscle mitochondria exposed in vivo and in vitro to a partially purified Clostridium perfringens alpha toxin. Depressed oxidative functions in the toxin-exposed, isolated mitochondria were concomitant with the electron-dense deposits. The mitochondria are suggested as the cellular site of action of the alpha toxin Author (TAB)

N67-11290# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPORTANCE OF ORTHOSTATIC DISTURBANCES IN RABBITS SUBJECTED TO TOTAL X-RAY RADIATION
P. V. Sipovskiy and L. V. Funshteyn 28 Apr. 1965 6 p Transl. into ENGLISH from Med. Radiol. (Moscow), v. 4, no. 3, 1959 p 80–81
(FTD-TT-65-53; TT-65-62271; AD-615283) CFSTI: HC $1.00/MF $0.50

In a definite combination the effects of radiation and orthostatic disturbance of the blood circulation are capable of mutally reinforcing the biological effect of each of these factors and bringing about the early occurrence of death. The load on the cardiovascular system from the orthostatic position, in addition to the action of the radiation, leads to its functional incapacitance with untimely and even unexpected death of radiated rabbits for which sublethal doses of radiation take on the significance of fatal doses which act so lethally that death sets in after 3 and 1/2 hours post-radiation. Author

N67-11391*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography with Indexes
Oct. 1966 232 p refs
(NASA-SP-7011(29)) CFSTI: HC$1.00/MF$1.25 CSCL 06S

A continuing bibliography related to the physiological, psychological, and environmental effects of interplanetary space and the earth's atmosphere on man is presented. References describing similar effects on biological organisms of lower order are also included. The abstracted material contains such topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors. In general, emphasis is placed on applied research, however, fundamental studies and theoretical principles are included. S.P.

N67-11400*# California Univ., Berkeley.
MOLECULES AND EVOLUTION
Thomas H. Jukes N. Y., Columbia Univ. Press, 1966 293 p refs
(Grant NsG-479)
(NASA-CR-79389) CFSTI: HC$6.00/MF$1.50 CSCL 06A

Some of the research dealing with biochemical reactions that are responsible for the structure, function, and survival of living organisms and that have a bearing on evolution are reviewed. Emphasis is placed on the concept that the number and sequence of chemical bases in molecules of DNA are a cryptogrammic record of the evolutionary history of each species. It is felt that the solution to the cryptogram comes from the study of proteins and the genetic code. The chemical nature of mutations, base sequences in the genetic code, mechanism of protein synthesis, and gene duplication are discussed in detail. L.E.W.

N67-11401# Joint Publications Research Service, Washington, D. C.
PROBLEMS IN AEROSPACE MEDICINE
V. V. Parin, ed. 21 Oct. 1966 816 p Transl. into ENGLISH of the book "Problemy Kosmicheskoy Meditsiny: Materialy Konferentsii 24–27 Maya 1966" Moscow, 1966 p 3–414
(JPRS-38272; TT-66-34698) CFSTI: $8.40

Articles on experimental investigations of certain biological, physiological, and psychological problems related to aviation and space flight environments are presented. For individual titles see N67-11402–N67-11677

N67-11402# Joint Publications Research Service, Washington, D. C.
DATA ON THE FOOD VALUE OF CERTAIN BIOCOMPONENTS OF SYSTEMS OF LIFE SUPPORT
I. A. Abakumova, L. K. Vasilenko, A. N. Kozlova, Yu. I. Kondrat'yev, and A. S. Ushakov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 6 (See N67-11401 02-04) CFSTI: $8.40

Preliminary data were obtained on the food value of yeast, mycobacteria, and unicellular algae in dietary experiments with rats. Pathological-anatomical autopsies of the animals after about one month of supervised deficiency feeding showed that the animals perished due to substantial exhaustion and emaciation. The average length of life for animals fed only biological masses of unicellular algae as protein source averaged 5.5 months; in the case of feeding with pure biological mass the average length of life was about one month. G.G.

N67-11403# Joint Publications Research Service, Washington, D. C.
THE SENSITIVITY OF POTATO SEEDS TO PROTON AND GAMMA RADIATION
V. M. Abramova, D. F. Gertsuskiy, L. V. Alekseyenko, L. V. Nevzgodina, and S. A. Popkova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 7–8 (See N67-11401 02-04) CFSTI: $8.40

Biological action of protons and gamma rays on potato seeds at a dose strength of 84 rad-sec and a dose range of 500 to 50,000 rad, respectively, showed considerably more radiation resistance than tubers possessed. Ionizing radiation caused changes in growth and development of potato seedlings with the protons having a greater retarding effect than the gamma rays; The 100% lethal dose for proton irradiated seeds was slightly more than 30,000 rads; for gamma rays this dosage exceeded 50,000 rads. G.G.

N67-11404# Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF RAPIDLY INCREASING HYPOXIA ON THE HUMAN ORGANISM
N. A. Agadzhanyan, I. R. Kalinichenko, A. G. Kuznetsov, I. I. Lepikhova, G. A. Nikulina et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 9–10 (See N67-11401 02-04) CFSTI: $8.40

Resistance time of humans to rapidly increasing hypoxia was studied by spirographic measurements of return respiration. Results on 28 test subjects showed expressive changes of physiological functions terminating in a loss of consciousness upon failure to provide oxygen in time. Subjects displayed cyanosis of the skin surface and mucous membranes, dyspnea, somnolence, disturbance of handwriting, tremors, and sometimes muscle spasms of the hand. Several individuals also complained of breathing difficulty, dizziness, darkening of the eyes, fever, headache, etc. Conditioned motor reaction effects showed increased time prolongation in problem solving and movement coordination. EEG changes displayed some suppression of alpha rhythm in the first phase and slow waves in the third phase. Heart contractions increased in frequency and showed flattened R and T waves in ECG patterns. Peripheral blood contained increased erythrocytes and oxycorticosteriods. G.G.

N67-11405# Joint Publications Research Service, Washington, D. C.

THE EXPERIMENTAL INVESTIGATION OF THE POSSIBILITY OF CULTIVATING HIGHER PLANTS ON A CULTURE MEDIUM FROM A BIOLOGICAL MINERALIZER IN THE CASE OF CLOSED GAS EXCHANGE

A. L. Agre, N. T. Nilovskaya, S. I. Tsitovich, M. M. Bokovaya, V. F. Variamov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 11–12 (See N67-11401 02-04) CFSTI: $8.40

Syntheses of organic compounds from inorganic compounds by photosynthesis of higher plants and biochemical oxidation of an urinary-fecal mixture were studied in an assimilation chamber and aerotank system. Observed gas exchange between higher plants and biocynosis of microorganisms-mineralizers confirmed the possibility of utilizing a mineralized urinary-fecal liquid as nutrient medium for higher plants. G.G.

N67-11406# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF THE POSSIBILITY OF THE MINERALIZATION OF WATER-FECAL MIXTURES BY THE METHOD OF WET BURNING

A. L. Agre, V. M. Ivanov, and V. N. Trukhachev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 13–14 (See N67-11401 02-04) CFSTI: $8.40

Mineralization of urinary-fecal mixtures was studied under increased temperatures and pressures. Optimum conditions of a 275° temperature and a pressure of 120 to 130 atmospheres for two hours duration resulted in 90–93% mineralization of an urinary-fecal mixture. The gaseous phase that formed as a result of the mineralization of the mixture consisted mainly of carbon dioxide, residual oxygen, and nitrogen. G.G.

N67-11407# Joint Publications Research Service, Washington, D. C.

REDISTRIBUTION OF THE NUMBER OF ERYTHROCYTES UPON A LOWERING OF THE ATMOSPHERIC PRESSURE

A. M. Adler *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 15–16 (See N67-11401 02-04) CFSTI: $8.40

The influence of lowered atmospheric pressure on the blood erythrocyte content of white mice was studied at altitudes of 3500 to 7000 meters. It was found that the original reduction of erythrocyte numbers at a rarefaction corresponding to 3500–5000 meters increased after two days, and an original reduction of 5500 to 7000 meters increased after one day in all animals. G.G.

N67-11408# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF THE RESULTS OF MEASUREMENTS OF DOSES OF COSMIC RADIATION IN NEAR-EARTH SPACE

Yu. A. Akatov, Ye. Ye. Kovalev, V. M. Petrov, S. J. Skvortsov, and L. N. Smirennyy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 17 (See N67-11401 02-04) CFSTI: $8.40

Cosmic radiation measurements at 200–400 km altitudes on different thicknesses of polyethylene were made by thermoluminescent dosimeters and photoemulsions. Results established a cosmic radiation dose of about 16 to 20 millirad per day; the dosage changed slightly with an increase in protective thickness. G.G.

N67-11409# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF ELECTROPHYSIOLOGICAL AND PSYCHOPHYSIOLOGICAL INDICES UNDER CONDITIONS OF PARTIAL ISOLATION AND HYPODYNAMIA

I. T. Akulinichev, A. Ye. Baykov, E. V. Bondarev, G. I. Gurvich, V. A. Yegorov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 18–19 (See N67-11401 02-04) CFSTI: $8.40

Psychophysiological and electrophysiological studies on two human subjects during a seven day period of isolation and adynamia were reported. Observed were functions of attention and memory, reflex to time, throughput capacity of the visual analyzer, and the time of a simple motor reaction and a selection reaction from two alternatives; readings of ECG, EEG, and EMG, and other physiological functions were also taken. During the course of the entire experiment, no deviations from the physiological norms of electrophysiological indices were detected; some slight shifts primarily in the neuro-emotional and psychic spheres were observed but found of little consequence. G.G.

N67-11410# Joint Publications Research Service, Washington, D. C.

SOME DATA FROM THE ELECTROPHYSIOLOGICAL INVESTIGATIONS OF THE CREW OF THE VOSKHOD-2 SPACE SHIP DURING ITS SPACE FLIGHT

I. T. Akulinichev, A. Ye. Baykov, P. V. Vasil'yev, I. I. Kas'yan, D. G. Maksimov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 20–21 (See N67-11401 02-04) CFSTI: $8.40

Electrocardiogram, pneumogram, seismocardiogram, electrooculogram, and body temperature measurements on two cosmonauts during an 18 orbit space flight are reported. During the third orbit, the cosmonauts' initially increased heart beat and respiration rate returned to normal, but some slowing of the pulse and respiration rate was observed on the seventh orbit. Average values of the ECG Q-T and R-R intervals in both cosmonauts corresponded to the changes in heart beat. Dynamic electrooculogram recordings were in accordance with pulse and respiration rate changes; during the entire course of the flight the eye movements of both astronauts were found sufficiently symmetrical. G.G.

N67-11411# Joint Publications Research Service, Washington, D. C.

IONIZATION OF THE AIR AS ONE OF THE FACTORS OF SPACE FLIGHT

S. P. Aleksandryuk, B. V. Anisimov, N. N. Komarov, Yu. G. Nefedov, A. N. Potapov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 22–23 (See N67-11401 02-04) CFSTI: $8.40

The biological effects of aeroionization in a space cabin were studied by luminescent analysis, mass spectrometry, and paramagnetic resonance as well as by changes in blood pictures of experimental animals. Even single session aeroionization caused changes in the resistance of erythrocytes of the peripheral blood to osmotic hemolysis, a change of adsorption properties with respect to vital stains, shifts in the metabolism of a series of physiologically active substances, a change in the ionic penetrability of the skin, and an increase in the mytotic activity of tissue. It was concluded that the brief action of radiation induced aeroions in a space cabin atmosphere is important for the human organism. G.G.

N67-11412# Joint Publications Research Service, Washington, D. C.

NEW DATA ON THE PROBLEM OF SPECIAL FUNCTIONAL DIAGNOSIS

V. N. Alifanov, V. P. Yerokhin, V. M. Kozin, G. L. Komandantov, L. M. Lemesheva et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 24–25 (See N67-11401 02-04) CFSTI: $8.40

The functioning of the cardiovascular system, respiration, acoustical analyzer, and the equilibrium and spatial orientation apparatus were studied under special loads imitating conditions of flight activity as well as under actual flight conditions. Healthy human subjects showed a quickening of cardiac activity and increased systolic and pulse pressure at an altitude of 5000 meters; fliers with arteriosclerotic cardiosclerosis had a pathological displacement of the S-T interval with inversion of the T wave in the four ECG chest LEADS' Functional shifts in pilots reached considerable magnitudes under flight conditions of considerable strain. Special functional

diagnostic models for investigations of latent vestibular disturbances in animals were used to obtain the compensation stability according to EMG indices and the appearance of the Flourens phenomena in chest–back and back–chest loads. G.G.

N67-11413# Joint Publications Research Service, Washington, D. C.

CHANGE OF PRECORDIAL VECTORELECTROCARDIOGRAMS UNDER CONDITIONS OF HYPOXIA IN FLIGHT PERSONNEL WITH INITIAL SYMPTOMS OF HYPERTENSION AND ATHEROSCLEROSIS

V. N. Alifanov and Ye. I. Kuznetsova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 26–27 (See N67-11401 02-04) CFSTI: $8.40

Discussed is the precordial vector electrocardiogram reaction of healthy and hypertonic flight personnel during 30 minute exposure to an hypoxic atmosphere of 5000 meters. All test subjects before "ascent" showed a predominance of the direction of the QRS vector to the left, up, and to the rear; this QRS orientation was generally preserved in all healthy persons under hypoxic conditions. Persons with beginning forms of hypertonic sickness produced a first plane displacement of the QRS vector to the right by about 5°, and in the second and fourth planes to the left by 10 and 5°, respectively. Persons with symptoms of hypertonic sickness in combination with arteriosclerosis showed slight displacements of the QRS vector to the right in the first, second, and fourth planes. The initial magnitude of the maximum QRS vector decreased in all persons exposed to hypoxia. G.G.

N67-11414# Joint Publications Research Service, Washington, D. C.

A QUANTITATIVE ESTIMATE OF CHANGES OF THE LATENT PERIOD OF CONDITIONED MOTOR REFLEXES DEPENDING ON THE NUMBER OF APPLIED STIMULI AND THE INTERVALS BETWEEN THEM

G. V. Altukhov, A. D. Yegorov, A. P. Polyakova, I. B. Svistunov, and S. A. Skuratova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 28–29 (See N67-11401 02-04) CFSTI: $8.40

An "emotion" unit was used to study the latent period duration in the conditioned reflex action of man under consecutive application of various light and sound stimuli, both with the same and with different probabilities after time intervals of 0.5, 2.5, 5.0, and 10.0 seconds. Results of 320 tests on 12 test subjects established that increased numbers of applied stimuli also increased the duration of the latent period in all probability combinations. A lesser duration of the latent period was found for shorter intervals between applied stimuli. G.G.

N67-11416# Joint Publications Research Service, Washington, D. C.

THE ABSORPTION OF GLUCOSE FROM THE SMALL INTESTINE IN VARIOUS GASEOUS MEDIA

N. Sh. Amirov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 31–33 (See N67-11401 02-04) CFSTI: $8.40

Sugar content and lactic acid in the blood and the wall of rat intestine during the process of glucose absorption from its lumen were studied under hypercapnic and hypoxic environmental conditions. To determine the sugar and lactic acid of the blood before and 30 minutes after glucose introduction into the lumen of the intestine, narcotized rats were placed in a chamber of a fixed gaseous environment after a small portion of their normal jejunum was removed. Comparison of data obtained under hypercapnic and hypoxic conditions showed that the stronger hyperventilation under hypercapnic conditions provided for the burning of absorbed glucose to the final products. Under hypoxic conditions, some partial glycolysis of the absorbed glucose in the organism and subsequent formation of lactic acid seemed likely. G.G.

N67-11417# Joint Publications Research Service, Washington, D. C.

THE CHANGE OF THE NEUROSECRETORY ACTIVITY OF THE HYPOTHALAMIC REGION UNDER THE ACTION OF SOME EXTREME FACTORS OF SPACE FLIGHT

L. A. Andrianova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 34–35 (See N67-11401 02-04) CFSTI: $8.40

Histochemical analyses on neurosecretory materials in the cells of the supraoptic and paraventricular hypothalamus nuclei of male rabbits, exposed to an acceleration of 10 g for four minutes or to a total gamma radiation dose of 400 roentgens, indicated a change of neurosecretory processes in the nuclei of the hypothalamic region. After acceleration for 10 to 15 minutes, and animals displayed antidiuretic activity of the blood plasma. Irradiated animals showed an accumulation of neurosecretion in the neurons of the supraoptical and paraventricular nuclei and intensified antidiuretic and oxytotic activity in hypothalumus extracts 3 hours after radiation exposure. Author

N67-11418# Joint Publications Research Service, Washington, D. C.

NEW DATA ON THE CHANGE OF THE REACTIVITY OF THE BODY UNDER THE INFLUENCE OF CERTAIN FACTORS OF SPACE FLIGHT

V. V. Antipov, V. A. Kozlov, B. I. Davydov, N. N. Dobrov, B. L. Razgovorov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 36 (See N67-11401 02-04) CFSTI: $8.40

The effects of vibration, acceleration, and ionizing radiation factors on the function of animal organisms were studied by pharmacological and physical loads. The use of cystamine before exposure to vibration at 70 cycles for one hour, with a load of 10 grams, curtailed the duration of swimming by the animals. Sensitivity of the animals to the toxic action of cystamine and strychnine increased somewhat under the influence of vibration. Reactivity changes of centrifuged animals to physical loads correlated with ceruloplasmin shifts in their blood. 40 days after proton irradiation at 120 mev, from 700 to 1770 rad, the resistance of the animals to physical loads was reduced. Preliminary centrifuging before irradiation slightly increased the radioactive resistance of all animals. G.G.

N67-11419# Joint Publications Research Service, Washington, D. C.

THE THERMOREGULATING FUNCTION OF THE CENTRAL NERVOUS SYSTEM UPON THE ACTION OF HYPOXEMIA AND HYPEROXEMIA

I. I. Antonov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 37–38 (See N67-11401 02-04) CFSTI: $8.40

Decorticized and decerebrated animals were studied for their thermoregulatory functions at various partial oxygen pressures and external temperatures. Tests showed that decortication increased the resistance of an animal organism to a high partial oxygen pressure of 5 atmospheres and to the low partial pressure of an 8000 meter altitude by about four times in comparison with intact animals; also observed was a considerable effect on speed and magnitude of temperature reduction in the investigated organs and tissues. The same temperature drop was also noted in decerebrated animals; however, the change of partial oxygen pressure somewhat increased the speed of the drop in temperature and thus confirmed the complete disrupting disability of decerebrated animals to regulate their body temperature under changed partial oxygen pressure. It was concluded that decortication eliminated and distorted the adaptational changes of heat exchange in animals. G.G.

N67-11420# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF DYNAMIC FACTORS ON THE FUNCTIONAL STATE OF THE OTOLITHIC PART OF THE VESTIBULAR ANALYZER

Z. I. Apanasenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 39–40 (See N67-11401 02-04) CFSTI: $8.40

Changes of the electromyographic characteristics of a labyrinth tonic reflex for the muscles of the rear extremities of guinea pigs exposed to vibration and centrifuging were compared with corresponding effects of actual flights in an orbiting spaceship. Exposure to two-time vertical vibrations at 70 cycles or to 15 minute acceleration at 8 G changed the functional condition of the electroactivity of the muscles and of the vestibular analyzer and apparently established the predominance of excitation. This effect was most pronounced after space flight. G.G.

N67-11421# Joint Publications Research Service, Washington, D. C.

THE RESULTS OF CLINICAL-PHYSIOLOGICAL INVESTIGATIONS OF THE CREW OF THE FIRST VOSKHOD MULTI-PLACE SPACE SHIP

I. M. Arzhanov, A. V. Beregovkin, I. I. Bryanov, P. V. Buyanov, S. N. Zaloguyev et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 41–42 (See N67-11401 02-04) CFSTI: $8.40

Some of the postflight physical and physiological changes found in the astronauts of the first Voskhod spacecraft are reported. Medical examinations revealed a slight general fatigue, hyperemia of the mucosa of the upper respiratory tract and the conjunctiva, body weight loss, moderate loss of working ability, poor tolerance of load tests, and neutrophilic leucocytosis and eosinopenia. R.N.A.

N67-11422# Joint Publications Research Service, Washington, D. C.

SOME RESULTS OF THE POST-FLIGHT EXAMINATION OF P. I. BELYAYEV AND A. A. LEONOV WHO MADE THE FLIGHT ON THE VOSKHOD-2 SPACE SHIP

I. M. Arzhanov, I. I. Bryanov, V. A. Baturenko, A. V. Beregovkin, P. V. Buyanov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 43–44 (See N67-11401 02-04) CFSTI: $8.40

Pre- and post-flight examinations were made of the Voskhod-2 cosmonauts and compared to determine the biological effects of space flight. The results of the examinations, which included measurements of the heart and brain biopotentials, arterial oscillograms and tachooscillograms, ballistocardiography, investigation of gaseous metabolism, physiological tests, and general clinical and biochemical examinations of the blood and urine, are briefly discussed. R.N.A.

N67-11423# Joint Publications Research Service, Washington, D. C.

THE ROLE OF THE VESTIBULAR ANALYZER IN THE RESPONSE REACTIONS OF AN ORGANISM TO RADIATION EFFECTS

N. I. Arleshchenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 45 (See N67-11401 02-04) CFSTI: $8.40

The vestibular apparatus under conditions of stress, such as those caused by weightlessness or the Coriolis effect, is shown to affect an organism's response reaction to radiation effects. R.N.A.

N67-11424# Joint Publications Research Service, Washington, D. C.

MATERIAL ON THE PHARMACOLOGICAL PROTECTION OF THE VESTIBULAR ANALYZER IN THE CASE OF RADIATION EFFECTS

N. I. Arleshchenko, L. N. Suslova, and L. N. Kvasnikova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 46 (See N67-11401 02-04) CFSTI: $8.40

The use of such pharmacological agents as vitamins, amino acids, and aminazine to protect the vestibular apparatus from the effects of ionizing radiation is discussed. R.N.A.

N67-11425# Joint Publications Research Service, Washington, D. C.

THE COMBINED EFFECT OF ACCELERATIONS, VIBRATIONS, AND RADIATION ON THE DIVISION OF THE CELLS OF THE BONE MARROW

M. A. Arsen'yeva, V. V. Antipov, L. A. Belyayeva, and A. V. Golovkina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 47–48 (See N67-11401 02-04) CFSTI: $8.40

The effect of the combined action of acceleration, vibration, and radiation on the frequency of nuclear disorders in the bone marrow cells of mice was studied. The mice were subjected to accelerations of 8 and 10 g's for 15 and 30 minutes and vibration (700 cycles for 60 minutes) before and after ionizing radiation. The animals were irradiated with X-rays in doses of 100 or 350 roentgens. The intervals between effects were 1, 4, and 24 hrs. An acceleration of 8 g's for 15 minutes with irradiation of 100 roentgens after 1 and 4 hours slowed the restoration rate of the cell's mitotic activity in comparison with straight radiation. The combination of acceleration (10 g's for 30 minutes) or vibration with irradiation (350 roentgens) after 24 hours caused some reduction in the frequency of true chromosome reorganizations. Vibration and acceleration (10 g's for 30 minutes) after irradiation (350 roentgens) increased the mitotic activity of the cells and slightly reduced the effect of radiation. R.N.A.

N67-11426# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF CRITERIA OF THE TOLERANCE OF TRANSVERSE ACCELERATIONS

D. Yu. Arkhangel'skiy, V. I. Babushkin, and E. V. Marukhanyan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 49 (See N67-11401 02-04) CFSTI: $8.40

The duration of the cardiac cycle was used as an objective criterion of an organism's tolerance of transverse accelerations. Fluctuations in the duration of the cardiac cycle make it possible to give a quantitative estimate of the magnitude of the physiological deviation and constitute an early sign of change in the functioning of the cardiovascular system. R.N.A.

N67-11427# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE INFLUENCE OF OPERATOR ACTIVITY ON THE DURATION OF THE CARDIAC CYCLE UNDER CONDITIONS OF INCREASED GRAVITATION

D. Yu. Arkhangel'skiy, A. N. Luk'yanov, and M. V. Frolov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 50 (See N67-11401 02-04) CFSTI: $8.40

The latent period of motor activity was determined in test subjects under the influence of prolonged transverse oriented acceleration within the range of 1 to 9 g's in performing operator activity, and a series of electrophysiological indices were registered. An analysis of the results established that the relative change of the average values of the cardiac cycle duration in the absence of operator activity in the first approximation increases in proportion to the magnitude of the acceleration. The relative change of the cardiac cycle duration based on the elementary operator activity in the first approximation does not depend on accelerations in the range from 1 to 6 g's. In this case the relative change of the average value of the latent period is slight. In accelerations higher than 6 g's the duration of the cardiac cycle decreases and the latent period increases. R.N.A.

N67-11428# Joint Publications Research Service, Washington, D. C.

HYPERVENTILATION AS A FUNCTIONAL TEST

N. M. Asyemolova, A. K. Kochetov, and V. B. Malkin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 51–52 (See N67-11401 02-04) CFSTI: $8.40

An investigation was conducted to analyze and establish the scientific basis for using hyperventilation as a functional test for selecting candidates for flight schools and for medical examination of flight personnel. An attempt was made to determine the significance of aspects of respiration itself with respect to the course of the hyperventilation syndrome. Dosed hyperventilation was performed with different frequency and depth of respiration for the same volume of lung ventilation. The decisive factor in the development of the hyperventilation syndrome, regardless of the structure of respiration, was found to be the volume of pulmonary ventilation. The development of hyperventilation occurred in three phases characterized by various shifts of carbon dioxide pressure in the alveolar air: 1) a rapid drop of carbon dioxide pressure which to some degree established an individual's sensitivity to hypocapnia, 2) a relative stationary level of carbon dioxide pressure in the alveolar air, and 3) the restoration phase. Also discussed are the results of undosed free hyperventilation, pathological reactions, and EKG shifts. R.N.A.

N67-11430# Joint Publications Research Service, Washington, D. C.

THE USE OF SEISMOCARDIOGRAPHY IN SPACE MEDICINE

R. M. Bayevskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 57–58 (See N67-11401 02-04) CFSTI: $8.40

The role of seismocardiography, which measures the contractive functioning of the heart, in space flight is discussed. Seismocardiography has been used to determine the effect of weightlessness on blood circulation and to study the homeostatic mechanisms of the cardiovascular system. The seismocardiographic instrument can be located on top of clothing or even in a vest pocket, and is very convenient for accomplishing a continuous medical check of the astronaut. A small size radio transmitter has been integrated with the seismocardiographic instrument which makes it possible to record a seismocardiogram under conditions of free movement. An algorithm has been developed for automatic analysis of the seismocardiogram, so that data can be obtained not only on the condition of the cardiovascular system, but also on respiration and motor activity, the condition of the vegetative system, and the emotional state. R.N.A.

N67-11431# Joint Publications Research Service, Washington, D. C.

THE SELECTION OF DIAGNOSTIC CRITERIA IN THE CONSTRUCTION OF AN ALGORITHM FOR AN ON-BOARD COMPUTER

R. M. Bayevskiy, G. A. Berezina, Yu. V. Bukharin, and S. A. Chernyayeva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 59–60 (See N67-11401 02-04) CFSTI: $8.40

An experimental check was made of a medical diagnostic program to determine its effectiveness in detecting sudden or gradual deviations in healthy persons. The programmed examination, which uses a 3-channel amplifying system, 4 investigational methods, and lasts only 5 minutes, is briefly described. Results show that the programmed examination provides a large number of different indices and forms diagnostic criteria from which clear distinctions can be made between normal and pathological conditions. The diagnostic effectiveness of various programs have been validated in the clinic and they now appear useful for both space and earth medicine. The use of these programs in combination with automatic data processing by on-board computers is a feasible means of solving problems of medical research and diagnosis during prolonged and distant space flights. R.N.A.

N67-11432# Joint Publications Research Service, Washington, D.C.

A COMPLEX METHOD FOR DETERMINING THE COMPENSATORY-ADAPTIVE CAPABILITIES OF THE CARDIOVASCULAR SYSTEM IN THE CASE OF ORTHOSTATIC EFFECTS

V. P. Baranova, T. V. Benevolenskaya, N. P. Yermakova, Ye. N. Kochina, G. P. Mikhaylovskiy et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 61–62 (See N67-11401 02-04) CFSTI: $8.40

A complex study was made of the functional condition of the cardiovascular system in healthy individuals under conditions of normal vital activity and following experiments simulating certain effects of space flight. The investigation made use of mechanocardiography, rhinopneumometry in combination with a change of body position, and an active orthostatic test. An electrocardiogram, an FKG, and sphygmogram of the carotid artery, a volumetric sphygmogram, and the arterial pressure were recorded, and the phases of cardiac activity were analyzed. A correlation was established between the data from the study of the hemodynamics, the rhinopneumometry, and the tolerance of orthostatic effects. In particular, poor tolerance of orthostatic effects occurred against a background of an increase in intranasal resistence of up to 35 to 50 mm of a water column, an increase in the minute volume of blood, a decrease in the peripheral resistance of the vascular canal, and an increase in the speed of cardiac ejection. R.N.A.

N67-11433# Joint Publications Research Service, Washington, D. C.

THE DIFFERENTIATED SENSITIVITY OF MAN TO THE CUMULATION OF VARIOUS VESTIBULAR STIMULI

U. P. Baranova and I. Ya. Yakovleva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 63 (See N67-11401 02-04) CFSTI: $8.40

A number of studies are briefly reviewed which show the differential sensitivity of the vestibular apparatus in tolerating an accumulation of vestibular effects, particularly Coriolis accelerations. R.N.A.

N67-11434# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF THE RELATION OF ORGAN-CHANGE AND TISSUE RESISTANCE

Z. I. Barbashova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 64–65 (See N67-11401 02-04) CFSTI: $8.40

Experiments were conducted on rats to compare the resistance of the whole organism to hypoxia with the resistance of its individual tissues. One group of rats had their resistance increased by a month of training in a barometric chamber at a simulated altitude of 7000 meters. Another group had their resistance lowered by an adrenalectomy. In rats of the first group, resistance was higher in the myocardium, skeletal muscles, brain tissue, and cells of the respiratory and vasculomotor centers. This is apparently connected with the higher activity of the cytochromoxidase and the higher oxygen capacity of the tissues themselves, as evidenced by the increase in myoglobin content. In rats that had adrenalectomies, resistance was reduced in the isolated myocardium. This was correlated with a decrease in the cardiac muscle's oxygen capacity due to a reduced myoglobin content. After a month of training for hypoxia, these same rats showed an increase in the resistance of the isolated myocardium which again was correlated with a rise in the myoglobin content in the cardiac muscle and an increase in the activity of the adenosinetriphosphatase. R.N.A.

N67-11435# Joint Publications Research Service, Washington, D. C.

THE INTERACTION OF THE ANALYZERS AND THE VEGETATIVE COMPONENTS OF MOTION SICKNESS

V. N. Barnetskiy and A. G. Kuznetsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 66 (See N67-11401 02-04) CFSTI: $8.40

A study was conducted on vegetative phenomena occurring during motion sickness in dogs caused by rocking. The criterion for vegetative disorders consisted of indices of the motor functioning

and electric activity of the muscle layer and nerve stems of the stomach and the occurrence of salivation and vomiting. On the average, vegetative phenomena occurred in the animals during vertical displacements with a frequency of 30 times/minute with accelerations of 0.3 g's every 10 to 15 minutes. These occurrences developed more rapidly in darkness. The most expressed reaction was attained when the animal was rocked in the absence of natural leg support. Evidently, visual signals and those from the proprioceptors of skeletal muscles have an inhibiting effect on the vestibular apparatus. Stimulation of the mechanoreceptors and chemoreceptors of the stomach increased the development of motion sickness. Motion sickness also increased more rapidly in dogs whose superior cervical sympathetic ganglia had been removed. Sodium bicarbonate injections sharply reduced the effects of rocking.
R.N.A.

N67-11436# Joint Publications Research Service, Washington, D. C.

THE ADRENAL CORTEX AND THE REACTIONS OF THE NERVOUS SYSTEM TO STRESS EFFECTS

T. S. Barutkina, T. T. Zarubaylo, M. I. Mityushov, A. D. Nozdrachev, A. N. Panov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 67–68 (See N67-11401 02-04) CFSTI: $8.40

Investigations were conducted on the reactions of the nervous system to various stresses and its dependence on the functioning of the adrenal cortex. Chronic tests on dogs with implanted electrodes showed that stress lowers the afferent and efferent impulsation in the sympathetic nerves. The administration of hydrocortisone prevents the suppression of electric activity, and desoxycorticosteronacetate either has no effect or suppresses it. The reaction of brain catecholamines to stress can depend on the corticosteroid level in the peripheral blood. The administration of large doses of hydrocortisone prevents the lowering of the catecholamine level of the brain in response to stress effects. The concentration of adenosine triphosphate, adenosinediphosphoric acid, adenosinemonophosphate, guanosinetriphosphoric acid, guanosinediphosphoric acid, lactic acid, citric acid, pyruvic acid, and ketoglutaric acid was measured in rat brain tissue after administering hydrocortisone in the state of rest and under the effect of an electrocutaneous stimulus. A prolonged stimulation did not change the indices of energy metabolism while a brief stimulation caused an increase in glycosis.
R.N.A.

N67-11437# Joint Publications Research Service, Washington, D. C.

CHARACTERISTICS OF THE ACTIVITY OF THE ADRENAL CORTEX AND THE THYROID GLAND AND HIGHER NERVOUS ACTIVITY UNDER CONDITIONS OF THE PROLONGED ACTION OF SOUND

T. S. Barutkina, T. T. Zarubaylo, M. I. Mityushov, A. N. Panov, V. V. Rakitskaya et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 69–70 (See N67-11401 02-04) CFSTI: $8.40

White rats were subjected to the effects of sound, using a frequency of 650 hertz and an intensity of 70 decibels. The duration of the sound varied from one hour to 14 days and was applied for 17 seconds out of every half minute. The functional activity of the rat's adrenal cortex, as determined by the reduction in the concentration of ascorbic acid and cholesterol, increased depending on the time of the sound effect, reaching a maximum in 6 to 12 hours. After 8 days, the condition of the adrenal cortex was normal. The functional condition of the thyroid was judged from the content of protein-connected iodine in the blood plasma and from histological sections. An increase in the gland's activity was observed after one day of sound effects, after which no differences from the norm were observed. A study of rat nervous activity showed that sound caused an increase in the latent period, a tendency to prolong the time of running, and an increase in errors.
R.N.A.

N67-11438# Joint Publications Research Service, Washington, D. C.

THE INCREASED RESISTANCE OF HYPOTHERMALLY CONDITIONED ANIMALS TO THE EFFECTS OF DECOMPRESSION

P. V. Beloshitskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 71–72 (See N67-11401 02-04) CFSTI: $8.40

Decompression tests were conducted on two groups of white rats. Rats of the first group were subjected to decompression at normal body temperature. The second group was first cooled to 22°±1°C in a specially designed thermal chamber and then exposed to decompression. The results showed that in the hypothermally conditioned rats, the lowering of PO_2 in the brain tissue is less than in nonconditioned rats. There were also less changes with respect to respiration and heart beat, i.e., the tissues are protected for a longer period of time against oxygen deficiency. It is possible that hypothermia also weakens the flow of impulses coming from the expanded chest cage and abdominal cavity, thereby reducing the probability of a reflex stoppage of respiration. The survival rate of the hypothermally conditioned rats was almost three times that of the unconditioned rats.
R.N.A.

N67-11439# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF THE FACTORS OF SPACE FLIGHT ON THE EXCRETION OF 17-OXYCORTICOSTEROIDS WITH THE URINE

M. I. Belyakova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 73–74 (See N67-11401 02-04) CFSTI: $8.40

A laboratory study was made on the effect of accelerations on the functioning of the adrenal cortex. The study showed that the accelerations caused an increase in the excretion of free and connected 17-oxycorticosteroids in direct relation to the magnitude of the acceleration. Post-flight examinations were also made of 17-oxycorticosteroid excretions of astronauts. A comparison of the data from the two studies shows that space flight causes no greater changes in the functioning of the adrenal cortex than the laboratory acceleration tests. The normalization of the excretion of 17-oxycorticosteroids during a short period of time following a considerable increase or reduction, indicates that these effects do not exceed the physiological capabilities of the adrenal cortex.
R.N.A.

N67-11440# Joint Publications Research Service, Washington, D. C.

A DOSED PHYSICAL LOAD IN THE DIAGNOSIS OF CHANGES OF THE FUNCTIONAL STATE OF THE CARDIOVASCULAR SYSTEM

T. V. Benevolenskaya, O. I. Boykova, M. M. Korotayev, G. P. Mikhaylovskiy, and A. A. Savilov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 75–76 (See N67-11401 02-04) CFSTI: $8.40

A method is described for diagnosing the functional state of the cardiovascular system. The method determines a subject's adaptability to a variable physical work load by recording a series of electrophysical parameters and detecting pathological changes in the cardiovascular system during the load with a veloergometer.
R.N.A.

N67-11441# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF GAMMA RADIATION AND PROTONS WITH ENERGIES OF 127–660 MeV ON THE RADIATION INJURY OF YEAST CELLS

V. N. Benevolinskiy, Yu. P. Druzhinin, A. S. Klimenko, T. S. Malyutina, and I. A. Sychkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 77–78 (See N67-11401 02-04) CFSTI: $8.40

Diploid cells of Saccharomyces vini strain Megri 139-13, and haploid cells of Saccharomyces cerevisiae strain 40-2587 were investigated. It was established that the action of protons

does not differ significantly from the action of gamma radiation. The coefficient of relative biological effectiveness of protons was close to 1 in all cases. On the basis of data obtained, a preliminary evaluation was made concerning the effects of radiation on quiescent yeast cells under space flight conditions when yeast is used as emergency material if the system for the continuous growing of heterotrophs were to fail. L.S.

N67-11442# Joint Publications Research Service, Washington, D. C.

THE BASIS OF THE CREATION OF A STORAGE PLACE FOR OXYGEN UPON THE OXYGENATION OF TISSUE UNDER INCREASED PRESSURE

I. P. Berezin, G. I. Seregin, and B. N. Rostovtsev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 79–80 (See N67-11401 02-04) CFSTI: $8.40

The preservation time of the electroencephalographic activity of the brain of a rabbit after the cessation of external respiration was experimentally investigated in series tests on 70 rabbits. Measurements of brain bioelectric activity were made after cessations for varying time periods, and under different atmospheric (pressure) conditions. Analysis of the data showed that the bioelectric activity under conditions of breathing oxygen under increased atmospheric pressure was always preserved considerably longer than in the case of normal pressure. The data indicate that the use of increased partial pressures of oxygen for the purpose of oxygenation, creates considerable supplies of oxygen in the tissues which under certain conditions can be used for therapeutic purposes. L.S.

N67-11443# Joint Publications Research Service, Washington, D. C.

THE CHANGE OF SOME PHYSIOLOGICAL INDICES OF THE BODY UNDER THE INFLUENCE OF A GASEOUS ENVIRONMENT FORMED AS A CONSEQUENCE OF THE DESTRUCTION OF POLYMERS

Yu. P. Bizin, G. M. Gorban, V. M. Zinov'yev, Z. I. Pilipyuk, K. K. Sidorov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 81–82 (See N67-11401 02-04) CFSTI: $8.40

The physiological changes occurring in laboratory animals situated in a sealed chamber (simulated space ship cabin) in which vapors from various organic polymers placed in the system were formed when temperatures became greater than 40°C were investigated. Changes in the quantity of erythrocytes, leucocytes, reticulocytes, and hemoglobin were determined. The functional condition of the liver was judged from the ability of the organism to synthesize hippuric acid from benzoic acid. In addition, integral methods of investigation such as the behavior and general condition of the animals, the dynamics of weight change, tolerance of physical load, and oxygen consumption, were used. Functional changes to the central nervous system were unstable and non-specific. The use of the investigated polymers in outfitting sealed cabins is possible if the harmful gaseous vapors of the listed materials are eliminated from the air, or are in allowable concentration for closed spaces of small volume. L.S.

N67-11444# Joint Publications Research Service, Washington, D. C.

PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF THE SEQUENCE OF MOVEMENTS IN MAN

I. D. Bogina, I. M. Gorbunova, Ye. S. Rogovenko, and N. A. Rokotova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 83–84 (See N67-11401 02-04) CFSTI: $8.40

The process by which human subjects learned a sequence of manipulations of keys on a panel was investigated. A concept was developed explaining the sequence of actions as the creation of internal criteria, and the performance of a learned sequence as the following of selected internal criteria. The results of the tests with respect to selection of the order of motor actions, the determination of the time for fulfillment, and the maintenance of regular speed of movement, are presented. The data indicate that the process of learning is a process of selecting and constructing internal criteria such as the direction of the movement of the hand (or the panel as used in the tests). The nature of the fluctuation in time intervals during a motor cycle is also discussed. L.S.

N67-11446# Joint Publications Research Service, Washington, D. C.

CHANGES OF THE VISUAL AFTER-IMAGE WITH DIFFERENT METHODS OF STIMULATING THE VESTIBULAR APPARATUS

B. B. Bokhov and I. V. Komissarova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 87–88 (See N67-11401 02-04) CFSTI: $8.40

Human subjects were turned at varying speeds to examine the relationship between the direction of the displacement of a visual after-image and angular and Coriolis acceleration. In addition, the relation between the degree of deviation of the after-image and the angular accelerations of different magnitude was studied. Tests involving irritation of the vestibular apparatus by stimuli confirmed previously obtained data on the displacement of the visual after-image in the direction of rotation upon stopping, and also revealed certain new aspects of this phenomenon. Results suggest that there is a possibility of quantitatively evaluating the spatial and time indices of the visual after-image from tests such as those described. L.S.

N67-11447# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF A TEST OF VERTICAL WRITING ON POST-ROTARY NYSTAGMUS

B. B. Bokhov and M. M. Frolova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 89 (See N67-11401 02-04) CFSTI: $8.40

The performance of human subjects in vertical writing tasks after being rotated at various speeds was tested to study the effects of various indices on vestibular nystagmus. The writing test was used as an index of the tonic labyrinth reflex to the musculature of the upper extremities. The recording of post-rotary nystagmus was accomplished at the same moment. Results indicate that the duration and number of occurrences of post-rotary nystagmus increase, while the amplitude decreases under the influence of a simultaneous writing test. This effect is particularly distinct upon stopping rotation at low speeds (15, 30°/sec.). A less noticeable decrease of duration of nystagmus is observed at a speed of 60°/sec. L.S.

N67-11448# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF A GEL CULTURE MEDIUM ON THE REACTIONS OF AN ORGANISM UNDER CONDITIONS OF A DEFICIENCY OF OXYGEN AND AN EXCESS OF CARBON DIOXIDE

I. S. Breslav and Ye. N. Salatainskaya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 90 (See N67-11401 02-04) CFSTI: $8.40

It was found that in gel media with both normal and reduced oxygen content, human respiration becomes faster and less flexible; while the saturation of the blood with oxygen differs little from that observed in nitrogen–oxygen mixtures. Under conditions of moderate hypoxia (12% O_2), the increase of pulmonary ventilation in a helium environment was more weakly expressed than in a nitrogen environment. The ability of the test subjects to distinguish such a mixture from an environment with a normal content of oxygen in helium was considerably less than in nitrogen. The reaction of man to inspiration of a mixture of 9% oxygen with helium was the same for all the studied indices as in the case of a similar nitrogen mixture. Author

N67-11449# Joint Publications Research Service, Washington, D. C.

ELECTROPHYSIOLOGICAL INVESTIGATIONS OF THE CENTRAL MECHANISMS OF GRAVITATIONAL COLLAPSE

Ya. M. Britvan, V. G. Lychko, and Yu. S. Belkaniya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 92–93 (See N67-11401 02-04) CFSTI: $8.40

Electroencephalographic measurements of bioelectric activity in cat brains under conditions of orthostatic (gravitational) collapse were analyzed. The potentials were determined from the sensomotor and occipital areas of the cerebral cortex, specific nuclei of the thalamus and anterior hypothalamus, the reticular formation of the middle brain, and the pons varolii. The data indicate that in a series of tests in which the cats were placed in a vertical position, gravitational collapse occurred after 6 to 10 hrs with complete extinction of bioelectric activity, a reduction of arterial pressure to 20–30 mm Hg, and terminal disturbances of respiration. The changes of bioelectric activity went through the following stages: initial desynchronization, a stage of mixed waves, dominance of slow activity, zones of silence, and finally complete suppression. Other observations of the bioelectric activity are also discussed. L.S.

N67-11450# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF TRANSVERSE ACCELERATIONS ON PANCREATIC SECRETION

S. A. Bugrov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 94 (See N67-11401 02-04) CFSTI: $8.40

Changes occurring in the external pancreatic secretion of animals from the action of transverse radial acceleration were investigated in a series of tests. Two types of reactions were noted: inhibition and excitation of pancreatic secretion. In one group of tested animals a clearly expressed undulation in the secretion of juice with sharp fluctuations in the periods of the rise and fall in the amount of juice was observed. In the second group, a certain plateau in the direction of an increase in the amount of juice with a slight amplitude for the periods of rise and fall was observed. Similar changes were observed with respect to the enzyme secreting function of the pancreas. L.S.

N67-11451# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF PENETRATING RADIATION ON FOOD PRODUCTS AND THE PHYSIOLOGICAL VALUE OF FOOD

I. M. Buznik *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 95–96 (See N67-11401 02-04) CFSTI: $8.40

It was shown that irradiation of food with large doses of gamma rays (about 2 million roentgens at a quantum energy of 1.25 MeV) leads to a worsening of the organoleptic (odor, color, taste) qualities and a reduction of the physiological value of food products. Changes occurring in fats, proteins, and vitamins are discussed. The data are useful when considered with other literature studies conducted at different radiation levels and types to determine if irradiated food for space astronauts is feasible. L.S.

N67-11452# Joint Publications Research Service, Washington, D. C.

PROLONGED HYPOKINESIA AS A FACTOR CHANGING THE FUNCTIONAL CONDITION OF THE CARDIOVASCULAR SYSTEM OF A WELL MAN

P. V. Buyanov, A. V. Beregovkin, N. V. Pisarenko, and V. I. Sissarev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 97–98 (See N67-11401 02-04) CFSTI: $8.40

Tachooscillograms, arterial oscillograms, and electrocardiograms of cardiac activity were recorded in human subjects being tested for the effect of prolonged restriction of mobility on the blood circulation. Subjects were tested under bed regime conditions and under water immersion. The duration of hypokinesis was 10 to 15 days. The significance of physical exercises and periodic kneading of the lower extremities to reduce the negative effect of hypodynamia was evaluated. The data will be of value in estimating the load tolerance that an astronaut can tolerate under weightlessness in space flight before serious disturbances occur to his cardiovascular system. L.S.

N67-11455# Joint Publications Research Service, Washington, D. C.

MOISTURE LOSSES OF THE HUMAN ORGANISM AT HIGH ALTITUDES

M. I. Vakar, N. I. Chernyakov, I. V. Maksimov, V. A. Glazkova, and P. Ya. Azhevskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 103–104 (See N67-11401 02-04) CFSTI: $8.40

The rate of moisture loss of humans subjected to prolonged stays at high altitudes (30,000 meters and higher) was studied with the aid of complex oxygen equipment for breathing under excess pressure. The subjects were dressed in compensating clothing which provided external mechanical counterpressure on the body but did not preclude contact by the skin surface with the deep vacuum and did not hamper the evaporation of moisture from the surface of the skin and from the underclothing. The water loss was determined by weighing the test subjects fully dressed before and after the experiment. Thermocouples were used to measure the skin and underclothing temperatures. It was established that prolonged stay in a state of physical rest leads to an increase in moisture loss exceeding that under ground conditions by 1.5–2 times (70–120 gms/hr vs 40–50 gms/hr). Performance of physical loads led to increases in water loss where similar loads under ground conditions caused less moisture loss. L.S.

N67-11456# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF AMINAZINE, METAMIZIL, AND PENTAPHENE ON CERTAIN VESTIBULAR REACTIONS

A. V. Val'dman, M. A. Burysk, and Ye. A. Spalve *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 105–106 (See N67-11401 02-04) CFSTI: $8.40

The effect of the central cholinolytes metamizil and pentaphene, and the adrenalyte aminazine on vestibular reactions of central origin: cardiac arhythemia, disturbance of coronary blood circulation, vascular reactions, nystagmus, and salivation were studied. Electrocardiographic data of the functioning of the heart and the state of coronary blood circulation were obtained on tested cats in which vestibular nuclei located at the bottom of the fourth ventricle were electrically stimulated. Results indicate that cholinolytic compounds are very useful for preventing the symptomatic complex of motion sickness. Metamizil is the most effective of the compounds studied. There are some doubts as to the prospects for using adrenalytic compounds (aminazine), but further research with this compound is necessary. L.S.

N67-11457# Joint Publications Research Service, Washington, D. C.

THE CHANGE OF CERTAIN INDICES OF THE FUNCTIONAL CONDITION OF THE ORGANISM UPON PROLONGED STAY BY MAN IN THE POSE OF "AVERAGE PHYSIOLOGICAL REST"

Yu. V. Vanyushina, M. A. Gerd, and N. Ye. Panferova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 107–108 (See N67-11401 02-04) CFSTI: $8.40

The pulse and respiratory rates, blood pressure magnitudes, and body temperatures of human subjects immersed in water (or in chairs of special design) were measured at 2 hr intervals during waking hours to determine the changes occurring in physiological indices that occur during a prolonged stay in the pose of average

physiological rest characteristic under weightlessness conditions. The basal metabolisms of the tested individuals were determined by the Douglas–Holden method each morning immediately after sleep. Periodic measurements of the maximum strength and endurance of the right and left hand muscles were made. It was found that the pulse and respiratory rates remained practically unchanged throughout the course of the tests, and that the level of maximum and minimum arterial pressure dropped progressively. The biological activity of the blood changed in the direction of a decrease in the chronotropic effect and increase of the inotropic effect. The basal metabolism was reduced during the course of testing, and the respiratory coefficient rose. Other comments on the fundamental transformation of functional systems under the conditions of physiological rests, are also made. L.S.

N67-11458# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF HIGH AIR TEMPERATURE ON THE ADAPTABILITY OF MAN TO AN ORTHOSTATIC TEST

Yu. V. Vanyushina, N. Ya. Panferova, and V. A. Tishler *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 109–110 (See N67-11401 02-04) CFSTI: $8.40

The body temperatures, moisture losses, cholinesterase activity, arterial pressure, and electrocardiogramic, seismocardiogramic, and neumogramic behavior of human subjects before and after 1–4 hr stays in a warm chamber (36–40°C) having relative humidity of 60–70% were measured to determine the mechanism of change in the adaptibility of man to orthostatics after such exposure. After being in the warm condition, the adaptibility of the test subjects to an orthostatic test was poorer; the frequency of cardiac contractions increased sharply; blood pressure fell; and in one case there was a precollaptoid conditon. In the vertical position the test subjects showed a shortening of the R–R and PQ intervals on their electrocardiograms, and an increase in the difference between the actual and necessary systolic indices. Other effects on the physiological functions are also described. L.S.

N67-11459# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF STRESS ON THE CONVERSION OF LIPIDS IN THE LIVER WITH QUALITATIVELY DIFFERENT FEEDING

E. N. Vasil'yeva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 111–112 (See N67-11401 02-04) CFSTI: $8.40

The reaction of rat livers, in which fat content was increased due to a deficiency of protein in the diet, to the administration of formalin stress agents was studied. The irritants caused a reaction of the organism characteristic of stress (decrease of the relative weight of the liver, increase of the weight of the adrenal glands, and a lowering of the ascorbic acid content in the adrenal glands). In the control animals all the stress agents caused an increase in the contents of lipids in the liver. The same stress agents in the case of rats with increased initial fat content in the liver not only caused no increase in the level of lipids but sometimes led to a lowering of lipid content in the liver tissue. Similar data with non-esterified fatty acids in blood serum showed that the mobilization of fat from the depot occurs just as intensively in control animals as in rats which had received an insufficient amount of protein in their diets. The data indicate that the different reaction of liver with different initial fat content is connected with the nature of the processes of the conversion of lipids in the liver tissue itself. Other comments on the studies are also made. L.S.

N67-11460# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE VASCULAR TONUS UNDER THE INFLUENCE OF HYPODYNAMIA

V. Ye. Vasil'yeva, O. N. Belina, and T. D. Vasil'yeva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 113–114 (See N67-11401 02-04) CFSTI: $8.40

Electrocardiographic recordings and sphygmograms from a radial artery and the end of a middle finger were made on athletic test subjects before and during a position of rest in a horizontal position without moving for 10 days to determine the effect of hypodynamia on the tonus of the vascular vessels. The data indicate that the speed of propagation of a pulse wave along vessels of the elastic type does not undergo noticeable changes during the 10 day period. However, vessels of the purely muscular type (arteries of the hand e.g.) considerably change their elastic-cohesive state. This is expressed in an abrupt change of the speed of propagation of the pulse wave. Under the influence of hypodynamia, the propagation speed along the muscular type vessels decreased. L.S.

N67-11462# Joint Publications Research Service, Washington, D. C.

THE MATHEMATICAL MODELLING OF THE CONSUMPTION OF OXYGEN BY THE BODY WHEN PERFORMING PHYSICAL WORK

V. K. Vasil'yev, B. S. Katkovskiy, and A. B. Savvin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 117–118 (See N67-11401 02-04) CFSTI: $8.40

In the proposed mathematical model, an analysis is made of the oxygen regime of the organism under standard physical loads of average intensity. The nature of the transitory process of oxygen consumption during activation (input into the regime) and restoration (removal of the load) is studied in response to gradual excitement (physical work), using an automatic gas analyzer. A second order differential equation is used to describe the process of oxygen consumption during physical work. Another differential equation is derived to describe the restoration process after completion of the work. An attempt is made to connect the coefficients of the equations for each process. It is reported that the model provides solutions which are in good agreement with experimental analyses. M.G.J.

N67-11463# Joint Publications Research Service, Washington, D. C.

INCREASING THE RESISTANCE OF ANIMALS TO TRANSVERSE-DIRECTED LOADS BY MEANS OF ACTIVE AND PASSIVE ACCLIMATIZATION UNDER CONDITIONS OF A HIGH MOUNTAINOUS AREA

P. V. Vasil'yev, G. V. Lysukhina, and N. N. Uglova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 119 (See N67-11401 02-04) CFSTI: $8.40

White mice, white rats, and guinea pigs were used in acclimatization studies undertaken as a method of nonspecific training for increasing the adaptive capabilities of an organism to extreme flight conditions. Test conditions are outlined. The results show: (1) The survival rate of acclimatized animals following the action of large magnitude loads was 1.5 to 2 times greater than that for control animals. The positive effect of acclimatization lasted for 3 to 4 weeks. (2) Cardiac disturbances occurred later in the test animals and were less severe. (3) Active adaptation to high altitude conditions, including systematic physical training, was more effective than passive stay at the altitude. M.G.J.

N67-11464# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF PROTON AND GAMMA RADIATION ON THE MITOTIC ACTIVITY OF AN INOCULATED CULTURE OF HUMAN CELLS

I. S. Vasil'yev, N. I. Ryzhov, N. N. Derbeneva, A. I. Portman, N. Zh. Dorofeyeva et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 120–121 (See N67-11401 02-04) CFSTI: $8.40

A two-week culture of amniotic cells in a single layer and in suspension was subjected to the action of 630 MeV protons and gamma rays of Co^{60}. The proton dose strength was 35 rad/sec; for the gamma rays it was 3 rad/sec. Activation and luminescence methods were used for the proton dosimetry; ionization chambers were used for beam monitoring. For gamma radiation, mitotic activity was determined directly after irradiation and after 12, 24, 36, and 48 hours; for proton radiation, after 10, 20, 40, and 60 hours. The experiments showed that irradiation causes a distinct change in the mitotic activity of the cells; the relationship between the suppression of mitotic activity and the dose was also noted. M.G.J.

N67-11465# Joint Publications Research Service, Washington, D. C.

MEASUREMENT OF ABSORBED DOSES OF INTERMEDIATE NEUTRONS

L. N. Veselovskiy, B. S. Gribov, V. G. Kuznetsov, and V. A. Sakovich *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 122 (See N67-11401 02-04) CFSTI: $8.40

Summary data are given on the use of detectors with isotropic sensitivity for investigating the effectiveness of biological shielding of a nuclear reactor. It is also reported that a directed detector with variable thickness for the moderating layer was created behind the biological shielding to study the angular characteristics of the neutron flow. M.G.J.

N67-11466# Joint Publications Research Service, Washington, D. C.

EVALUATION OF THE RADIATION DANGER IN A FLIGHT TO THE MOON

A. I. Vikhrov, V. Ye. Dudkin, Ye. Ye. Kovalev, V. G. Kuznetsov, and L. N. Smirennyy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 123 (See N67-11401 02-04) CFSTI: $8.40

Solar flare radiation is identified as the greatest hazard that astronauts will encounter during lunar flights and landings. It is reported that behind shielding of about 1 gram/cm^2 the surface dose can reach about 10^4 rem from a high intensity flare; if the astronaut is in a radiation shelter, the doses can be reduced to 50 rem or less. It is also noted that the probability of a solar flare during maximum solar activity is about 10% for a 30-day period. M.G.J.

N67-11467# Joint Publications Research Service, Washington, D. C.

THE PRINCIPLES OF CALCULATING PROTECTION FROM SPACE RADIATION

A. I. Vikhrov, V. Ye. Dudkin, Ye. Ye. Kovalev, V. G. Kuznetsov, A. V. Kolomenskiy et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 124 (See N67-11401 02-04) CFSTI: $8.40

Abstracted data are presented on the problems associated with calculating protection against high energy corpuscular radiation. A general formulation of the problem is proposed whereby for the given initial conditions (trajectory, flight duration, etc.), the basic requirements are determined for astronaut protection against radiation doses greater than the allowable limits while achieving a minimum weight increase. M.G.J.

N67-11468# Joint Publications Research Service, Washington, D. C.

SOME ADAPTIVE REACTIONS OF THE BLOOD SYSTEM OF MAN AND ANIMALS UNDER CONDITIONS OF PROLONGED OXYGEN STARVATION

V. I. Veytkevich *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 125–126 (See N67-11401 02-04) CFSTI: $8.40

Changes in the composition of the peripheral red blood were studied, along with the humoral stimulators of hemopoiesis in the blood serum, the change in the quantity of blood in the brain, and the oxygen-linking properties of hemoglobin. Investigations were conducted on alpinists before their ascent, during one month in the mountains at altitudes of 2000 to 4000 meters, and for a month after their descent. Under conditions of oxygen deficiency, observations showed a parallel increase of both the amount of hemoglobin and the number of erythrocytes in the peripheral blood, and the preservation of hemopoietic activity of the serum for up to two weeks after cessation of the hypoxic factor. Also studied were 13 generations of white rats which lived for 12 hours a day in a hypoxic chamber into which was fed a mixture of 10.5% oxygen and 89.5% nitrogen at normal atmospheric pressure. Test results are summarized, and it was concluded that under conditions of prolonged oxygen deficiency a series of adaptive shifts appear in the blood system. M.G.J.

N67-11469# Joint Publications Research Service, Washington, D. C.

APPLICATION OF THE METHODS OF SPACE CARDIOLOGY IN THE CLINIC AND SOME PROBLEMS OF THE CLINICO-PHYSIOLOGICAL EVALUATION OF THE RESULTS OF FLIGHT EXPERIMENTS IN SPACE

Yu. N. Volkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 127–128 (See N67-11401 02-04) CFSTI: $8.40

Clinical data are reported on the compensatory mechanisms observed in patients with atherosclerogenic cardiosclerosis, and on the effects of hypodynamia in patients subjected to a bed regime. The interrelationships of the methods and systems developed for medical control and physiological research in space with those of clinical practice are pointed out. Based on the observations a series of recommendations is proposed with respect to diagnostic criteria as applied to operational medical control during space flight. M.G.J.

N67-11470# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE MOTOR-EVACUATORY ACTIVITY OF THE GASTROINTESTINAL TRACT IN DOGS AFTER THE ACTION OF RADIAL ACCELERATIONS

T. V. Volkova, A. P. Mukhina, and V. Ye. Potkin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 129–130 (See N67-11401 02-04) CFSTI: $8.40

Balloon-graphic and roentgenological methods were used in experiments conducted on dogs with stomach fistulas to study hungry periodic motor activity. Indices were the time of work and rest periods, along with the time of the full cycle of stomach and duodenum activity. The animals were subjected for three minutes to the effects of overloads on a centrifuge, and a magnitude of 8 g, with the forces acting in a transverse direction. Test details and results are outlined. Findings show that increased gravitation causes changes in both the hungry periodic motor activity and the evacuatory functioning of the digestive tract; the period of restoration is from 3 to 9 weeks. M.G.J.

N67-11472# Joint Publications Research Service, Washington, D. C.

THE EXPERIENCE OF EMPLOYING A FUNCTIONAL TEST OF RESPIRATION UNDER EXCESS PRESSURE UPON HAVING MEDICAL EXAMINATION AND EXPERTISE FOR FLIGHT PERSONNEL

P. F. Vokhmyanin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 133–134 (See N67-11401 02-04) CFSTI: $8.40

Summary data are presented to show that by using a certain physiological load as a functional test, the functional condition and working ability of flight personnel can be determined based on the changes in the cardiovascular activity indices when breathing under excess pressure. Findings indicate that good tolerance of the load is found in persons preserving or increasing the minute volume of the heart during a load for 5 minutes at 10% or more than the initial figure, and in cases where the minute volume of

the heart is equal to the required value or within ±10% of it. Persons showing a decrease of the minute volume of the heart by more than 30% in relation to the required values are considered to have tolerated the load satisfactorily; persons with more than a 30% decrease are classified as having tolerated the functional test poorly. M.G.J.

N67-11474# Joint Publications Research Service, Washington, D.C.

THE BIOELECTRIC REACTIONS AND OXYGEN TENSION OF CERTAIN PARTS OF THE BRAIN IN THE CASE OF HYPOXIC HYPOXIA

L. S. Gezalyan, Ya. A. Il'in, and A. N. Razumayev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 137–138 (See N67-11401 02-04) CFSTI: $8.40

Experiments were conducted to observe the sequence of the appearance of changes in the EEG in various parts of the brain, their agreement with the functional condition of the brain, and the physiological mechanisms on which they are based. In the rabbits used for the tests, electrodes were implanted in the sensory area of the cortex, the hippocampus, the rear hypothalamus, and the reticular formation of the middle brain; polarographic methods were used for recording oxygen tension in the cortex and reticular formation. Hypoxia was induced by breathing nitrogen through a mask equipped with a valve for exhaling. Test results are summarized. It was found that three characteristic phases of changes on the EEG occurred during the development of hypoxia: (1) the reaction of arousal; (2) the domination of slow waves; and (3) the fading of electrical activity. M.G.J.

N67-11475# Joint Publications Research Service, Washington, D.C.

THE MECHANISM OF HUMAN ADAPTATION TO AN ANTIORTHOSTATIC POSE

K. L. Geykhman and M. R. Mogendovich *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 139–140 (See N67-11401 02-04) CFSTI: $8.40

Arterial oscillography, pulsotachometry, cutaneous thermometry, and oxyhemography methods were used to study hemodynamic shifts in 128 athletes. Muscle tonus was measured with an electromyotonometer. It was found that the handstand used for the antiorthostatic pose is characterized by (1) less frequent cardiac activity; (2) an increase of the maximum and a lowering of the minimum pressure with a small change of the average pressure and an increase in the oscillatory index; (3) a considerable increase in the skin temperature of the forehead, along with insignificant changes of the skin temperature of the hip; (4) decreased blood oxygenation; and (5) a sharp increase in muscle tonus of the hands, and a slight increase in muscle tonus of the legs. M.G.J.

N67-11477# Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF CHANGE OF THE HEART IN PILOTS WITH A DISTURBED ELECTROLYTE BALANCE

B. L. Gel'man, G. L. Strongin, L. I. Kuznetsova, and Ye. I. Kuznetsova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 143–145 (See N67-11401 02-04) CFSTI: $8.40

As a functional test for characterizing coronary insufficiency in persons suffering from stenocardia, flight personnel were given 150 grams of glucose. Based on complex clinical and clinical-physiological examinations, the subjects were grouped according to persons having (1) atherosclerosis, (2) hypertonic sickness of the first stage, (3) hypertonic sickness complicated by atherosclerosis, and (4) myocardial cardiosclerosis; the fifth group was basically healthy. Test details and results are summarized. Among the findings reported are: A considerable lowering of the T wave was observed in the test subjects of all groups. However, whereas such a lowering was noted in only 10% of the healthy persons, personnel with hypertonic sickness in combination with atherosclerosis showed an incidence of 31%. The most significant changes in the glucose test and shifts of electrolyte exchange and carbohydrate exchange were observed in persons with identified coronary insufficiency. M.G.J.

N67-11478# Joint Publications Research Service, Washington, D.C.

ESTIMATION OF THE RADIATION DANGER TO PLANTS OF A SPACE HOTHOUSE

D. F. Gertsuskiy, L. V. Nevzgodina, L. V. Alekseyenko, V. M. Abramova, and L. N. Smirennyy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 146–147 (See N67-11401 02-04) CFSTI: $8.40

In a test to study the effects of gamma rays and protons on potatoes, it was found that with a dose of about 4000 rad only individual tubers produce sprouts. A stimulating effect is obtained from a gamma ray dose of 500 to 1000 rad, and from a proton dose of not more than 250 rad. In the irradiation of potato seeds, the plants were ruined in the case of a proton dose of about 40,000 rad and a gamma ray dose of more than 50,000 rad. Beets, beans, and lettuce showed greater radiation resistance than do potatoes, while cabbage, carrots, radishes, and tomatoes were observed to have relatively high radiation resistance. In work performed to determine the relative genetic and biological effectiveness of 660 MeV protons in comparison with gamma rays of Co^{60}, it was found that as the dose increases the coefficients of the relative genetic effectiveness of protons increases. M.G.J.

N67-11479# Joint Publications Research Service, Washington, D.C.

THE EFFECT OF PROTONS OF 660 MEV AND GAMMA RAYS ON POTATOES UPON PRE-PLANTING IRRADIATION OF THE TUBERS

G. F. Gertsuskiy, V. M. Abramova, L. V. Alekseyenko, M. A. Sychkov, S. A. Popkova et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 148–149 (See N67-11401 02-04) CFSTI: $8.40

Germination, development rate, and number and yield of tubers were used as the basic criteria in evaluating the effects of irradiation. Summarized data on the results are presented. It was noted: (1) A dose of protons on the order of 250 rad had a stimulating effect on the speed of appearance of shoots and on the beginning of the budding phase. For gamma rays the required dose was 500 to 1000 rad. A noticeably inhibiting effect was observed beginning with a dose of 500 rad and over 1000 rad respectively. (2) Visual observations of the vegetating plants showed that the stimulating effect of small doses is most apparent in the first phases of development and disappears gradually with time. (3) Protons have a greater effect on the growth, development, and yield of potatoes than do gamma rays. M.G.J.

N67-11481# Joint Publications Research Service, Washington, D.C.

THE DYNAMICS OF THE SATURATION OF THE BLOOD WITH OXYGEN IN MAN WHEN BREATHING UNDER EXCESS PRESSURE AT HIGH ALTITUDE

V. A. Glazkova, I. V. Maksimov, and I. N. Chernyakov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 152–153 (See N67-11401 02-04) CFSTI: $8.40

Experiments conducted at altitudes above 12,000 meters indicated that oxygen saturation in the blood rose 3 to 5% during active and long conversation or when counting aloud. The saturation fell rather sharply, at least 20%, when subjects performed physical tests; and the size of the drop was dependent upon the exertion encountered by the subject. At altitudes of more than 12,000 meters, oxygenation of the blood changed according to the absolute intrapulmonary pressure, which in turn determined the level of alveolar pO_2. M.W.R.

N67-11482# Joint Publications Research Service, Washington, D. C.

STUDY OF THE EFFECT OF PROTONS OF 126 MeV AND GAMMA RAYS OF COBALT-60 ON THE PROCESSES OF CELL DIVISION IN THE BONE MARROW OF WHITE RATS

R. D. Govorun and S. V. Vorozhtsova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 154–155 (See N67-11401 02-04) CFSTI: $8.40

Mitotic activity, destructive processes in brain cell nuclei, and disturbances in the cell division processes were investigated in white rats that were subjected to various doses of whole-body irradiation with 126 MeV protons and gamma rays from Cobalt 60. A distinct change in mitotic index of the bone marrow was found with increasing doses; and there was an increase in the number of metaphases for 6 to 48 hours following irradiation, as well as a decrease in number of prophases and anaphases during the first day. A considerable increase in the number of degenerated nuclei is observed during the first day; and there was less damaging action from the protons than the gamma rays. Magnitude of relative effectiveness of the two types of irradiation varied according to when the tests were performed, and chromosome aberrations were related to dosage. To carry on these studies, the rats were decapitated at 1, 3, 6, 12, and 24 hours; as well as 2, 4, 7, 20, and 30 days after exposure. M.W.R.

N67-11483# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF EVALUATING THE MUSCULAR WORKING CAPACITY OF MAN AFTER THE ACTION OF SHOCK LOADS

S. A. Gazulov and N. I. Frolov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 156–157 (See N67-11401 02-04) CFSTI: HC $8.40

Muscular working ability in man, following the effects of repeated and stronger shock loads, is considered to pass through three stages. First, there is a predominant improvement of working ability; next, a discoordination stage; and last, a stage of lowered ability. It is noted, however, that because of a redistribution of functions and mutual compensation, there is a relatively small decrease in working ability. Further, there is great variation among individuals. Details of the study are not included. M.W.R.

N67-11484# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF CONSIDERABLE MUSCLE LOADS AND OF CERTAIN PHARMACOLOGICAL PREPARATIONS ON THE SUBSEQUENT RESISTANCE OF WHITE RATS TO RADIATION

D. A. Golovacheva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 158–159 (See N67-11401 02-04) CFSTI: $8.40

Testing of trained white rats indicates resistance to radiation is directly related to the level of muscular working ability developed during the training period. Optimum physical loads, which are not defined, increase radiation resistance; whereas an exhausting working regime or slight loads do not produce beneficial results. There was a 31% survival rate in rats who were trained for 2 to 3 months and then subjected to radiation doses of 1100 roentgens; for the untrained control group, a 100% mortality rate was noted. Other studies, which combine training with pharmacological intervention produced radiation resistance against a high level of muscular working ability. M.W.R.

N67-11485# Joint Publications Research Service, Washington, D. C.

TRACE REACTIONS IN AN EEG OF A MAN AND THEIR MEANING IN EVALUATING THE FUNCTIONAL STATE OF THE BODY

F. D. Gorbov and V. I. Myasnikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 160–161 refs (See N67-11401 02-04) CFSTI: $8.40

Electroencephalographic studies in man indicate that the occurrence of drowsiness during periods of brisk activity under conditions of isolation is a highly developed ability to relax, as well as a favorable protective-adaptive mechanism of the organism to monotonous conditions. Considerable similarity is noted between drowsy states and fatigue itself; and the dynamics of EEG trace reactions, especially the exalted flashes of alpha rhythm in response to stopping a light stimulus, were investigated. M.W.R.

N67-11487# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF THE PROLONGED ACTION OF VESTIBULAR AND ORTHOKINETIC STIMULI ON THE FREQUENCY SPECTRA AND THE REACTION OF THE ASSIMILATION OF THE RHYTHMS OF LIGHT FLICKERINGS IN ELECTROCORTICOGRAMS OF VARIOUS PARTS OF THE BRAIN OF RABBITS

N. P. Gordeyeva and V. A. Il'yanok *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 164–165 (See N67-11401 02-04) CFSTI: $8.40

Electrodes were implanted in the visual, parietal, motor, and frontal areas of the cerebral cortexes in rabbits to study both the separate and combined action of vestibular and optokinetic stimuli. In the case of low intensity light flashes, there is an even decrease in the magnitude of the assimilated rhythm as well as the high and low frequencies at all the leads. Vestibular stimuli are found to reduce the frequency spectra of EKG's at all areas of the brain and at all frequencies except the lower ones of from 4 to 7 hertz, which display increased spectra. Under the combined action of vestibular and optokinetic stimuli, there is a continuous drop at all frequencies beginning at 6 or 7 hertz; at 4 hertz, there is a sharp increase. M.W.R.

N67-11488# Joint Publications Research Service, Washington, D. C.

THE REACTION OF THE BLOOD SYSTEM OF A DEVELOPING ORGANISM TO THE BRIEF AND REPEATED ACTION OF LOW PARTIAL PRESSURE OF OXYGEN

L. S. Gorozhanin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 166–167 ref (See N67-11401 02-04) CFSTI: $8.40

Reaction of the blood system to sharp and repeated action of a partial oxygen pressure of 56 mm Hg was studied in 23 dogs of various ages. Both the redistributive and erythropoietic reactions to hypoxia are absent in dogs during the first two months of their lives; and during the first month, dogs subjected to hypoxia often display an acute reaction in the bone marrow. During the third month of life, an acute erythrocyte reaction appears that is preserved during subsequent stages of post-natal ontogenesis; and acute reticulocytosis is also observed at this time. Thus, it is concluded, that the protective erythrocyte reactions to the effects of hypoxia are not evidenced from birth, but are linked to the age-related formulation of the neuro-humoral mechanisms that regulate the blood system. M.W.R.

N67-11490# Joint Publications Research Service, Washington, D. C.

THE COMPENSATORY REACTIONS OF AN ORGANISM UPON THE DEVELOPMENT OF DECOMPRESSION DISTURBANCES

P. M. Gramenitskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 170–171 (See N67-11401 02-04) CFSTI: $8.40

Tests were made on dogs, cats, and rabbits to study their defensive compensatory reactions, such as formation of free gas bubbles within the blood, following exposure to decompression conditions. The main link in the pathogenesis of decompression disturbances is considered to be the aero-embolism formation in

the overall venous system as well as in the pulmonary vessels. The formation of gas bubbles as a result of rapid decompression offers protection to the anim Although details are not given, it is stated that it is possible to train the organism to accept decompression effects and to form artificial embolisms. M.W.R.

N67-11491# Joint Publications Research Service, Washington, D. C.

EVALUATING THE DANGER AND ESTABLISHING THE ALLOWABLE DOSES OF IONIZING RADIATION FOR ASTRONAUTS ON A FLIGHT TO THE MOON

Yu. G. Grigor'yev, M. P. Domshlak, N. G. Darenskaya, and S. A. Rayevskaya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 172 (See N67-11401 02-04) CFSTI: $8.40

Mention is made of the development of a classification and magnitude of radiation doses that would be encountered during short space flights and lunar exploration. It is noted that large laboratory animals were used to evaluate the effects of ionizing radiation, but none of the details are included. M.W.R.

N67-11492# Joint Publications Research Service, Washington, D. C.

RADIATION SAFETY FOR SPACE FLIGHTS

Yu. G. Grigor'yev and Ye. Ye. Kovalev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 173–174 (See N67-11401 02-04) CFSTI: $8.40

A suggested system to provide protection from radiation hazards during space flight includes: (1) safety measures for the compartments and a radiation shelter; (2) radiation dosimetry including on-board equipment, individual dosimetric control, and signal and warning devices; (3) means to provide pharmacochemical prophylaxis and therapy for radiation injury; and (4) a ground radiation safety service. Mention is made of the complexity of problems associated with radiation hazards, as well as the interaction of these problems with other aspects of space flight. M.W.R.

N67-11493# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF NITROGEN-OXYGEN AND HELIUM-OXYGEN HYPEROXIA ON THE MORPHOLOGICAL COMPOSITION OF THE BLOOD OF MICE

P. A. Gul'tyayev and N. M. Pogodina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 175–176 (See N67-11401 02-04) CFSTI: $8.40

Leukopenic reactions are stronger in mice exposed to helium-oxygen atmospheres than those placed in nitrogen-oxygen environments, with oxygen content about 80% in both instances. In the N-O environment, lymphopenia was frequently combined with nitrophilosis after exposures of from 4 to 11 days; while in He-O atmosphere, lymphopenia was combined with neutropenia at various time intervals after exposure. Leukocyte count was generally reduced in both environments, and shifts in morphological composition of the blood are about the same in either case. M.W.R.

N67-11494# Joint Publications Research Service, Washington, D. C.

THE FUNCTIONAL STATE OF THE ANALYZERS AND THE REACTIVITY OF AN ORGANISM

G. I. Gurvich *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 177 (See N67-11401 02-04) CFSTI: $8.40

Mention is made of the ability of animals to acclimate themselves to rarefied atmospheres. The general readjustment of an organism is caused by the sensitivity of the chemoreceptors during hypoxia; and specifically the cardiovascular receptors provide the link for changes in the functioning of the central nervous system and the reactivity of the organism as a whole. M.W.R.

N67-11495# Joint Publications Research Service, Washington, D. C.

THE ROLE OF CHANGES OF THE PARTIAL PRESSURE OF OXYGEN OF THE TISSUES IN REGULATING REGIONAL BLOOD CIRCULATION THE CASE OF ACUTE HYPOXIA

M. I. Gurevich and S. A. Bershteyn *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 178–179 (See N67-11401 02-04) CFSTI: $8.40

Acute hypoxia in cats under the influence of chloralose-nembutal narcosis was investigated in various gaseous mixtures with reduced oxygen contents. It was found that not all tissues received the same amount of oxygen; the cerebral cortex, for instance, received oxygen at the expense of the skeletal muscles and the skin. There is a redistribution of blood in the organism which is related to tonus changes in peripheral blood vessels. Conclusions are based on changes in oxygen tension and tissue blood flow in a hip muscle, skin of the stomach, and the parietal area of the cerebral cortex. Arterial pressure was measured at the femoral artery, and oxygen requirements were met at this point. M.W.R.

N67-11497# Joint Publications Research Service, Washington, D. C.

FUNCTIONING OF EXTERNAL RESPIRATION IN THE PROCESS OF HIGH ALTITUDE ACCLIMATIZATION AND UNDER CONDITIONS OF EXTREME DEGRESS OF RAREFACTION OF THE ATMOSPHERE IN A BAROMETRIC CHAMBER

G. A. Davydov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 182–183 (See N67-11401 02-04) CFSTI: $8.40

External respiration in man was studied following exposure to high altitude conditions, and gaseous metabolism at extreme levels of atmospheric rarefaction was investigated in a barometric chamber. Following 40 days stay at 4200 meters, the lung capacity did not change; but there is evidence of initial rise in respiratory rate. Respiratory volume increases throughout the stay in the mountains, the breath can be held for shorter periods of time in the rarefied atmosphere, and basal metabolism and respiratory values go back to their original values upon return to the lower altitudes. Studies in the simulated rarefied atmosphere indicate that respiratory rate changes only slightly on ascent, the lung capacity does not display regular changes, the time holding capacity at a simulated altitude of 7500 meters is half that on the ground, and alveolar ventilation upon ascent drops more slowly in persons acclimatized to high altitudes than those who are not. M.W.R.

N67-11498# Joint Publications Research Service, Washington, D. C.

EXPERIMENTAL INVESTIGATIONS OF THE LINK OF HIGHER PLANTS FOR A SYSTEM OF A CLOSED CYCLE OF MATTER

V. P. Dadykin, Ye. V. Lebedeva, N. T. Nikovskaya, and I. V. Tsvetkova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 184 (See N67-11401 02-04) CFSTI: $8.40

A model was calculated for use in the study of higher plants in a closed ecological system, and it was shown that increased yields can be obtained for certain plants than result under normal cultivation conditions. While the details are not presented for either the type of plant or the model, mention is made of the determination of optimum light regimes, characteristics of plant metabolism, and the use of nutrients to replenish mineral supplies expended by the plants. M.W.R.

N67-11499# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE TOLERANCE OF A FLOW OF HEAT AGAINST THE SURFACE OF THE SKIN OF A PERSON

I. I. Dadenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 185–185 (See N67-11401 02-04) CFSTI: $8.40

Absorption of heat by a unit of skin surface was studied by blackening the skin of 172 test subjects, and mirrored-type drying lamps were used for the irradiation source. Intensities ranged from and increased from 2 to 16 cal/cm^2 min, and tolerance time was found to decrease with increasing intensity. With an increase in the heat flow intensity and, to a lesser degree, the area subjected to radiation, the temperature level of the pain threshold decreases. M.W.R.

N67-11501# Joint Publications Research Service, Washington, D. C.

NEW DATA ON THE MECHANISMS OF THE ACTION OF IONIZING RADIATION ON THE FUNCTIONAL PROPERTIES OF THE RETINA

G. G. Demirchoglyan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 189–190 (See N67-11401 02-04) CFSTI: $8.40

Definite morphological and histochemical changes in the retinas of rabbits are observed following exposure to ionizing radiation, and electroretinograms note shifts in functional properties. Despite these changes, the irradiated optical system continues to perceive and process visual information. Preservation of impulsation in the optical nerve of frogs is noted under intensive radiation, and a lessening in the content of free sulfhydril groups in solutions of rhodopsin, extracted from the retinas of frogs by amperometric titration, is evidenced even though there is not a change in the liberation process for these groups. M.W.R.

N67-11502# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE DYNAMICS OF TRAINING THE CARDIOVASCULAR SYSTEM IN FLIGHT PERSONNEL

T. T. Dzhamgarov, Yu. K. Demiyanenko, L. A. Kustov, and V. L. Marishchuk *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 191–192 (See N67-11401 02-04) CFSTI: $8.40

Examination of EKG's and MKG's of flight personnel showed that a poor reaction to a work load was related to low scores on a modified Harvard step test in almost two-thirds of the subjects; high indices were exhibited by only 9% of the subjects exhibiting poor reactions. The high percentage of failures evidenced by flight personnel in training who had below average scores on the step test is reported as statistically significant. Throughout the testing, unique individual reactions to work loads were reported; thus, emphasizing the importance of the need for highly standardized testing procedures. M.W.R.

N67-11503# Joint Publications Research Service, Washington, D. C.

THE EFFECT ON THE ORGANISM OF ANIMALS OF REPLACING THE NITROGEN OF THE AIR WITH HELIUM UNDER CONDITONS OF A DEFICIENCY OF OXYGEN AND INCREASED CONCENTRATIONS OF CARBON DIOXIDE GAS

A. G. Dianov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 193–194 (See N67-11401 02-04) CFSTI: $8.40

Experiments conducted on rats who were placed in chambers without regenerative oxygen supplies indicate that when helium is replaced for the nitrogen in the atmosphere at 22°C, there is a 42% increase in length of life of the animals. As the chamber temperature increases, this life-prolonging effect decreases; and at 36°C, there are no statistically significant results between the effects of helium-oxygen environment and the air atmosphere. These findings are attributed to the fact that at the higher temperature, there is no difference between body heat and that of surroundings; whereas at the lowered temperature, a cooling effect is provided. M.W.R.

N67-11504# Joint Publications Research Service, Washington, D. C.

ELECTROPHYSIOLOGICAL ANALYSIS OF THE ROLE OF THE DIAPHRAGM NERVES IN THE MECHANISM OF THE VESTIBULAR REACTION OF THE ILEUM

A. S. Dmitriyev and Ye. V. Burko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 195–196 refs (See N67-11401 02-04) CFSTI: $8.40

A rotational load on narcotized dogs is reported to produce changes in the frequency characteristics of the bioelectric activity in an intact neck nerve; with increases in pulse amplitude accompanying pulse frequency increases. This strengthened reaction is accompanied by suppression of motor functioning in the ileum, and, in 76% of the cases, disappears completely following two-sided cutting of the diaphragm nerves in the neck. In labyrinthless animals, there are no significant changes in bioelectrical activity of the central and peripheral ends of the diaphragm nerve; but in animals with intact labyrinths, there is intensification of pulsation in the center and no change in the peripheral ends. M.W.R.

N67-11505# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE NEURO-HUMORAL MECHANISM OF VESTIBULAR INFLUENCE ON THE MOTOR FUNCTIONING OF THE ILEUM

A. S. Dmitriyev and A. A. Pushkarchuk *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 197–198 refs (See N67-11401 02-04) CFSTI: $8.40

Rotation of animals with intact nervous systems and labyrinths causes a significant increase in adrenaline as well as simultaneous suppression of the motor activity of the ileum; and these changes become more marked as the rotational load increases. With intact labyrinths and sectioned splanchnic nerves, the inhibiting actions of the ileum are decreased by 30% under 0.16 g and 6% under 0.6 g loads. The extralabyrinthal systems play a significant role in the case of larger rotational loads, whereas the vestibular nature of the humoral shifts in the blood and the reaction of the ileum are implicated in the case of the smaller loads. M.W.R.

N67-11506# Joint Publications Research Service, Washington, D. C.

THE SIGNIFICANCE OF THE ADRENAL AND THYROID GLANDS IN ADAPTATION TO HYPOXIA AS A METHOD OF INCREASING THE RESISTANCE OF THE ORGANISM

V. P. Dudarev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 199–200 refs (See N67-11401 02-04) CFSTI: $8.40

The role of the adrenal and thyroid glands in gradual acclimatization to high altitudes was investigated, along with the effect of the thyroids on resistance to acceleration action. An adrenalectomy in rats is accompanied by a reduction in erythrocyte content and hemoglobin in the circulating blood; and high level acceleration decreased survival rate, whereas administration of ACTH, cortisone, and desoxycorticosterone acetate resulted in a return to the original or higher life expectancy. Rats without thyroid glands were found to be capable of adapting to the higher altitudes; and although their consumption of oxygen was reduced, these rats exhibited almost the same increase in hemoglobin and erythrocyte content as the intact animals. It is noted that in all of the animals these increases were greater when the initial level was lower and the degree of oxygen insufficiency was reduced. M.W.R.

N67-11508# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE ACCURACY AND STABILITY OF TIME-FORCE REACTIONS IN VARIOUS POSITIONS OF THE HUMAN BODY

B. A. Dushkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 203–204 (See N67-11401 02-04) CFSTI: $8.40

Functional tests of muscular strength, endurance, feeling of time, and muscle-joint sensitivity, as well as determinations of mental and physical working ability, were used to study the accuracy and stability of time-force reactions in various body positions that might be encountered by an astronaut for a prolonged period of time. There is a gradual adaptation to a forced position that is related to the time spent in it; and working capacity decreases with the complexity of the position. The prolonged stay in an inconvenient position disturbs coordination of force reactions and calculating time; and this is apparently related to the cyclic course of stimulation and inhibition in central nervous system neurons.
M.W.R.

N67-11509# Joint Publications Research Service, Washington, D. C.
SOME PROBLEMS OF THE PLANNING AND ANALYSIS OF PHYSIOLOGICAL FLIGHT EXPERIMENTS
B. B. Yegorov, A. D. Yegorov, A. A. Kiselev, and I. S. Shadrintsev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 205–206 (See N67-11401 02-04) CFSTI: $8.40

Mention is made of the critical analysis of physiological information obtained on man and animals during space flights, as well as of the planning of flight experiments. The selection of parameters and interpretation of data are listed as tasks of primary importance, and mathematical models are considered necessary to the solution of these physiological problems.
M.W.R.

N67-11510# Joint Publications Research Service, Washington, D. C.
THE FUNCTIONAL CONDITION OF CERTAIN INTERNAL ORGANS UPON THE ACTION OF RADIAL FORCES AND CORIOLIS FORCES DURING MULTI-DAY EXPERIMENTS IN A SLOWLY ROTATING ROOM
P. I. Yegorov, T. V. Benevolenskaya, M. M. Korotayev, M. B. Reutova, L. M. Filatova et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 207 (See N67-11401 02-04) CFSTI: $8.40

Various functional changes in internal organs are observed on six healthy subjects who were confined for three and six days in a rotating room. At a rotational speed of 40°/sec for three days, changes included: (1) hypoglycemia and inadequate reaction of pancreatic beta cells to insulin secretion, (2) acute hyperkaliemia and moderate reduction in kidney functioning, (3) decreased liver secretions, and (4) a tendency for certain blood changes, such as increase activity of the cholinesterase and a sharp drop in properdin. At a speed of 10°/sec for a 7-day stay, reactions included: (1) lowered T-wave and electrocardiograms at all leads, (2) less adaptability of the cardiovascular system to physical loads, (3) stronger oculocardiac reflexes, and (4) lowering of cholinesterase activity and increase in propardin in the blood.
M.W.R.

N67-11511# Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF HYPOKINESIA AND A FOOD RATION OF HOMOGENIZED PRODUCTS ON THE FUNCTIONAL STATE OF THE HUMAN ORGANISM
P. I. Yegorov, V. S. Dupik, N. P. Yermakova, M. M. Korotayev, Ye. N. Kochina et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 208–209 (See N67-11401 02-04) CFSTI: $8.40

When four young men were confined in a horizontal position under conditions of limited isolation, all of them displayed a decreased respiratory volume and lung capacity. The two who received a special diet, but with the same 2200 calories as those who received ordinary food, displayed a greater increase in oxygen consumption. Changes in EKG's, noted for all the subjects for more than 12 days after the experiment, were lowering of the R and T voltage waves, bradicardia, and a turning of the axis to the right.
M.W.R.

N67-11512# Joint Publications Research Service, Washington, D. C.
RESULTS AND WAYS OF STUDYING THE FUNCTIONING OF CERTAIN ANALYZERS AS APPLIED TO THE CONDITIONS OF SPACE FLIGHT
M. D. Yemel'yanov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 210–211 (See N67-11401 02-04) CFSTI: $8.40

Analysis is made of data related to vestibular functioning and motor activity under space flight conditions. Among the observations made are: (1) transitory changes in gastrointestinal functioning and liver secretions, (2) loss of weight, (3) decrease of diuresis, (4) increase of Ca and K content of blood, (5) neurodynamic disturbances, and (6) and some increase to light sensitivity.
M.W.R.

N67-11513# Joint Publications Research Service, Washington, D. C.
THE QUESTION OF THE INFLUENCE OF OXYGEN ON THE LEVEL OF ACTIVITY OF ACETYLCHOLINESTERASE OF THE BRAIN OF ANIMALS
N. S. Yeremeyev and G. V. Troshikhin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 212–213 (See N67-11401 02-04) CFSTI: $8.40

Prolonged effects of hyperoxic environments with varying amounts of oxygen are investigated in terms of activity of the acetylcholinesterase in the brain of white mice. This activity is found to increase with increasing oxygen content in the atmosphere, and is considered primarily due to an increase in the functioning of the vegetative nervous system.
M.W.R.

N67-11517# Joint Publications Research Service, Washington, D. C.
THE SPEED OF THE FORMATION OF CONDITIONED REFLEXES AND THE LEVEL OF THE ABSORPTION OF THE OXYGEN IN ANIMALS LOCATED FOR A PROLONGED PERIOD IN A HELIUM ATMOSPHERE ENRICHED WITH OXYGEN
A. G. Zhironkin and G. V. Troshikhin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 221 (See N67-11401 02-04) CFSTI: $8.40

A decrease in the speed of conditioned reflexes and motor reactions and an increase in the level of gaseous metabolism in mice exposed to a prolonged stay in a helium environment enrichment with oxygen is attributed to the thermal conductivity role of helium which facilitates the cooling of the animals and shifts their heat comfort zone. By the end of the 12-day stay, the EEG showed congestive exaltation of the alpha rhythm; and the EMG was reduced from 300 to 200 microvolts upon the appearance of sudden signals and from 650 to 480 microvolts for cutaneous signals.
M.W.R.

N67-11518# Joint Publications Research Service, Washington, D. C.
SOME RESULTS AND PROSPECTS OF STUDYING THE BIOLOGICAL ACTION OF SPACE RADIATION AND DYNAMIC FLIGHT FACTORS WITH THE HELP OF MICROBIOLOGICAL AND CYTOLOGICAL MODELS
N. N. Zhukov-Verezhnikov, I. N. Mayskiy, G. P. Tribulev, N. I. Rybakov, I. I. Podoplelov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 222–223 (See N67-11401 02-04) CFSTI: $8.40

Results of biological effects on Vostok and Voshkod spacecraft are reviewed in terms of cosmic radiation hazards. It is noted that there is an increased sensitivity of lysogenic bacteria to gamma radiation if the system is first subjected to the effects of vibration. Mention is made of the use of cytological models and the restoration of cells during spaceflight.
M.W.R.

N67-11520# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF A CHANGED GASEOUS ENVIRONMENT ON THE OCCURRENCE AND COURSE OF DECOMPRESSION DISORDERS

V. P. Zagryadskiy, O. Yu. Sidorov, and Z. K. Sulimo-Samuylo *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 226 (See N67-11401 02-04) CFSTI: $8.40

The influence of excess carbon dioxide and the resulting decompression disorders are investigated in dogs and rats, some of whom had been previously acclimated to a gaseous environment. More rapid and profuse formation of gas emboli is facilitated by a preliminary stay in an atmosphere with increased carbon dioxide content, and decompression sickness results more frequently under these adverse conditions than in a normal air environment. M.W.R.

N67-11521# Joint Publications Research Service, Washington, D. C.

THE FUNCTIONAL CONDITION OF THE CENTERS OF THE NERVOUS SYSTEMS OF MAN AND ANIMALS UPON THE FORMATION OF A SPASMATIC REACTION UNDER CONDITIONS OF HYPEROXIA

G. L. Zal'tsman, I. D. Zinov'yeva, A. A. Savich, and A. I. Selivra *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 227–228 (See N67-11401 02-04) CFSTI: $8.40

The results of an investigation of higher nervous activity during conditions of hyperoxia are briefly discussed. It is reported that there are shifts in the functional state of individual brain structures during the initial phase of increased oxygen pressures. However, these shifts are still compensated for and are not manifested in behavioral and vegetative reactions, a change of which would have an adaptive character. A.G.O.

N67-11522# Joint Publications Research Service, Washington, D. C.

TRANSAMINASES OF THE BLOOD AS AN INDEX OF THE TOLERANCE BY MAN OF THE SHOCK LOADS OF LANDING

I. P. Zinov'yeva, L. A. Rubashkina, and V. K. Kostin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 229–230 (See N67-11401 02-04) CFSTI: $8.40

The feasibility of using transaminases of the blood as criteria to determine human tolerance characteristics during landing load conditions is considered. It is reported that investigations which were conducted showed that under the action of shock loads the activity of transaminases is a sufficiently sensitive test which makes it possible to a certain degree to judge the reaction of an organism to an applied effect. A.G.O.

N67-11523# Joint Publications Research Service, Washington, D. C.

THE BIOLOGICAL EFFECT OF A 12-TIME REPEATED GAMMA RADIATION TREATMENT OF WHITE MICE

T. M. Zukhbaya, M. P. Kalandarova, B. A. Markelov, N. A. Popova, Ye. P. Sizan et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 231–232 (See N67-11401 02-04) CFSTI: $8.40

Results are presented from an investigation in which white mice were subjected to repeated once-a-month gamma radiation with a dose of 12.5 roentgens to a total dose of 150 roentgens/year. Consideration is given briefly to the hemopoietic system, mitotic activity in cornea epithelium, chain motor conditioned reflexes, and radiation injury compensation in the central nervous system. A.G.O.

N67-11524# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF CHANGES OF RESPIRATION, BLOOD CIRCULATION, AND BLOOD UNDER THE CONDITIONS OF THE COMPLEX ACTION OF A CHANGED GASEOUS ENVIRONMENT AND FUNCTIONAL DEAFFERENTATION OF THE CENTRAL NERVOUS SYSTEM

Yu. N. Ivanov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 233–234 (See N67-11401 02-04) CFSTI: $8.40

Consideration is given to the effect of gaseous environment changes on central nervous system functions. It is reported that deafferentation of the central nervous system and the subsequent change of the cerebral cortex functional state inevitably lead to a drop in the sensitivity of the reactions of respiration, blood pressure, satruation of the blood with oxygen, and the blood to the action of a changed gaseous environment. A.G.O.

N67-11525# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF THE PARTIAL PRESSURE OF OXYGEN IN VARIOUS FORMATIONS OF THE BRAIN WHEN BREATHING OXYGEN UNDER NORMAL CONDITIONS, AFTER UNDERGOING ANOXIA, AND IN THE CASE OF DISTURBANCES OF BLOOD CIRCULATION IN THE BRAIN

Ye. A. Il'in *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 235–236 (See N67-11401 02-04) CFSTI: $8.40

Oxygen partial pressure measurements in the cortex, hippocampus, hypothalamus, and the reticular formation of the brain stem indicated that rhythmic changes occur in the initial pressure level at a frequency of 2–6 fluctuations per second. In three experiments the increase of pO_2 in the cerebral cortex upon breathing oxygen was preceded by a slight decrease, apparently indicating the vasoconstrictive influence of the oxygen. After anoxia the breathing of oxygen led to a considerable increase of the pO_2 in the cerebral cortex and in the subcortical formations of the brain. In the case of brain circulation disturbance due to an increase of intracranial pressure the oxygen regime did not change. A.G.O.

N67-11526# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF THE FUNCTIONAL STATE OF THE BLOOD CIRCULATION APPARATUS IN A ATHLETES UNDER THE INFLUENCE OF RESTRICTION OF MOTOR ACTIVITY

L. A. Ioffe, Yu. M. Stoyda, and T. D. Vasil'yeva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 237–238 (See N67-11401 02-04) CFSTI: $8.40

The prevention of unfavorable effects from limited motor activity on the functioning of the cardiovascular system is considered. Results are presented from studies on the effects of a 10-day bed regime on the electrical activity of the heart and on the readings of cardiodynamics and arterial pressure in highly qualified weightlifters and distance runners. A.G.O.

N67-11529# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF DECALCINATION IN THE CASE OF HYPODYNAMIA OF MAN AS APPLIED TO THE CONDITIONS OF PROLONGED SPACE FLIGHT

L. I. Kakurin and Ye. N. Biryukov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 242–243 (See N67-11401 02-04) CFSTI: $8.40

An outline is given of the problem of decalcination that is experienced as a result of a restriction in muscular activity. The physiological reactions based on a disturbance of the calcium metabolism are cited, and it is concluded that preventative problems can be solved in experiments conducted on earth. C.T.C.

N67-11530# Joint Publications Research Service, Washington, D. C.

THE ROLE OF THE CERVICAL AND ABDOMINAL REGIONS OF THE SYMPATHETIC NERVOUS SYSTEM IN CHANGES OF THE BLOOD AND BLOOD CIRCULATION UPON THE ACTION OF CHRONIC HYPOXIA AND IONIZING RADIATION

T. V. Kalinina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 246–247 (See N67-11401 02-04) CFSTI: $8.40

Experiments were conducted with 227 male rats, with different series of rats subjected to chronic hypoxia in the form of a month of training. This training consisted of four hours each day in a barometric chamber with gradual ascent to an altitude of 7500 meters and subsequent irradiation with various doses of X-rays. The effects of removing the cervical and abdominal parts of the sympathetic nervous system were then investigated by following the indices of the peripheral blood, blood pressure, and the tonus of the peripheral vessels. Various other procedures, observations, preliminary results, and conclusions are presented. C.T.C.

N67-11532# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF MEXAMINE ON THE GASEOUS METABOLISM OF ANIMALS UNDER CONDITIONS OF A CHANGED GASEOUS ENVIRONMENT

Ye. Ya. Kaplan and V. V. Ogleznev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 250 (See N67-11401 02-04) CFSTI: $8.40

The effect of mexamine (5-methoxytryptomine) on the gaseous metabolism of white rats under conditions of increased and reduced oxygen content was investigated. Results indicated that there was a reduction in the consumption of oxygen and release of carbon dioxide (by 10–35%). Based on these results it was concluded that antioxidants such as mexamine can be used to increase the resistance of organisms to oxygen starvation. A.G.O.

N67-11533# Joint Publications Research Service, Washington, D. C.

INCREASING THE RESISTANCE OF AN ORGANISM TO HYPOXIA WITH THE HELP OF ANTIOXIDANTS

Ye. Ya. Kaplan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 251–252 (See N67-11401 02-04) CFSTI: $8.40

An investigation was conducted to determine the effects of the pharmacological agents, mexamine, BYe-57, and ambunol, on the resistance of an organism to oxygen deficiency under conditions of aviation and space flight. It was established that respiration stoppage occurred later in animals which had received the antioxidants. Based on these experimental results it was concluded that the use of agents from the antioxidant group is fully justified. A.G.O.

N67-11536# Joint Publications Research Service, Washington, D. C.

ANALYSIS AT THE NEURON LEVEL OF THE READJUSTMENT OF THE RESPIRATORY CENTER UNDER CONDITIONS OF BREATHING WITH EXCESS INTRAPULMONARY OXYGEN PRESSURE

M. V. Kirzon and G. G. Chernova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 256–258 (See N67-11401 02-04) CFSTI: $8.40

A study was made of the bulbar respiratory neurons in cats which had been narcoticized with nembutal and in cats which had been decerebrated by means of an intracellular microelectrode lead, under conditions of excess intrapulmonary oxygen pressure. The significant results are a confirmation of the existence of a readjustment in the activity of the respiratory center, and an indication of its nature at the neuron level. C.T.C.

N67-11538# Joint Publications Research Service, Washington, D. C.

THE POSSIBILITY OF USING A POLYCARDIOGRAPHIC METHOD FOR CHECKING THE CONDITION OF ASTRONAUTS IN FLIGHT

A. A. Kiselev, S. O. Nikolayev, and G. K. Chizhov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 261–262 (See N67-11401 02-04) CFSTI: $8.40

Consideration is given to the possibility of using a polycardiographic method for evaluating the condition of blood circulation in a space flight environment. This method is based on an analysis of the phase structure of the cardiac cycle with the aid of polycardiographic curves. It is reported that this method can be used to give a quantitative characterization of the contractive ability of the myocardium, determine the time relation between the electrical and mechanical manifestations of heart activity, and evaluate the condition of the apparatus for the regulation of blood circulation. C.T.C.

N67-11539# Joint Publications Research Service, Washington, D. C.

A THERMOGRAM OF THE BRAIN OF ANIMALS SUBJECTED TO THE INFLUENCE OF ACCELERATIONS

V. Ya. Klimovitskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 263–264 (See N67-11401 02-04) CFSTI: $8.40

An experiment is reported in which the temperature of the carotid artery and the parietal and frontal surfaces of the brain was recorded during transverse and longitudinal accelerations. Results of the experiment indicate a probable suppression of functional heat production in the tissues of the brain after accelerations. C.T.C.

N67-11540# Joint Publications Research Service, Washington, D. C.

REACTION OF THE CEREBELLUM TO AFFERENT STIMULATION UNDER THE INFLUENCE OF LOADS

L. D. Klimovskaya, N. P. Smirnova, and A. T. Poleshchuk *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 265–266 (See N67-11401 02-04) CFSTI: $8.40

The reaction of the cerebellum to afferent effects which might be experienced during space flight was investigated in white rats. The method of evoked potentials was used on rats subjected to the action of transverse directed overloads of 10 g for 4 minutes. It was found that the acceleration causes considerable changes in the functional state of the afferent systems of the cerebellum. The significant conclusion is that the transition to a state of weightlessness occurs upon disruption of the adequate perception of afferent impulsation by the cortex of the cerebellum. C.T.C.

N67-11541# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE FOOD VALVE OF THE PROTEIN OF UNICELLULAR ALGAE

N. S. Klyushkina, I. T. Troitskaya, A. S. Ushakov, and V. I. Fofanov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 267 (See N67-11401 02-04) CFSTI: $8.40

The procedure used to determine the food value of the protein of unicellular algae for application to life support systems is briefly discussed. Two groups of rats, one with unicellular algae as the only protein source and the other with casein and soy protein sources, were examined. Results indicated that the protein of the unicellular algae (chlorella and scenedesmus) had high biological value, but it was also noted that the rats on this diet showed some lagging in weight. L.E.W.

N67-11542# Joint Publications Research Service, Washington, D. C.

BASIC PROBLEMS OF MODELING THE EFFECTS OF SPACE RADIATION ON BIOLOGICAL OBJECTS

Ye. Ye. Kovalev, V. I. Popov, and M. A. Sychkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 268 (See N67-11401 02-04) CFSTI: $8.40

Methods used to model the effects of various types of space radiation on biological subjects are briefly considered, and some of the problems involved are mentioned. It is pointed out that the time parameters and magnitude of the effect of space radiation are modeled with the help of gamma radiation. For the modeling of solar flares, the physical conditions for the radiobiological experiments were created using a synchrocyclotron in a range of energies up to 50 MeV. A device was made for the irradiation of cultures by multicharged ions to simulate the ends of the path of heavy charged particles. It was also felt that the radiation effect of heavy ions on large biological specimens might be modeled by using microcollimated beams of high energy electrons. L.E.W.

N67-11543# Joint Publications Research Service, Washington, D. C.

THE DYNAMIC OXYGENOTOPOGRAPHY OF AN ORGANISM

Ye. A. Kovalenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 269 (See N67-11401 02-04) CFSTI: $8.40

Various topics related to the dynamics of oxygen in an organism are briefly summarized. These include basic levels of oxygen tension in various organs and tissues, the use of oxygenotopography, and movement of oxygen into the tissues based on diffusion theory. L.E.W.

N67-11545# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF PHYSIOLOGICAL INDICES IN A TEST OF PROLONGED STANDING IN EVALUATING THE FUNCTIONAL CONDITION OF AN ORGANISM IN THE AFTERMATH OF PROLONGED STAND EXPERIMENTS

O. P. Kozarenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 272–273 (See N67-11401 02-04) CFSTI: $8.40

An experiment involving prolonged standing (20 min) for the purpose of investigating aspects of the interaction of the motor and vascular systems in accomplishing locomotor and pose establishing activity is briefly summarized. An uneven lowering of the vascular and muscular tonus was noted and a condition of asthenia occurred. It was pointed out that shifts in the recorded physiological indices provided evidence of a change in the mechanisms for regulation of the physiological functions which provide the optimum reaction in each case outside of the experimental influence. L.E.W.

N67-11547# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF PRESERVING DRINKING WATER USING IONIC SILVER

G. I. Kozyrevskaya, Yu. S. Koloskova, N. N. Sitnikova, S. V. Chizhov, and Z. P. Pak *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 275–276 (See N67-11401 02-04) CFSTI: $8.40

The problems involved in preserving the taste and sanitary hygienic qualities of drinking water for the crews of spacecraft are briefly outlined. Experimental data on the properties of ionic silver used as a preserving agent are mentioned. It was pointed out that the minimum dose of silver that provides a persistent bactericidal effect for 6 months is 0.1 mg/liter; ionic silver in doses 10 times or more in excess of the minimum bactericidal dose does not have a toxic effect on the organism of test animals; and man's use of water preserved by ionic silver in a dose of 0.1 mg/liter for 15 days does not cause any pathological changes in the functional conditions of the organs or systems. L.E.W.

N67-11548# Joint Publications Research Service, Washington, D. C.

A ROTARY TEST AS A METHOD OF DETERMINING LATENT FORMS OF MOTION SICKNESS UNDER CONDITIONS OF WEIGHTLESSNESS

I. A. Kolosov, I. F. Chekirda, V. I. Lebedev, G. F. Khlebnikov, and I. I. Kas'yan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 277–279 (See N67-11401 02-04) CFSTI: $8.40

Several astronauts, who had previously demonstrated high resistance of the vestibular analyzer to motion sickness, were subjected to a modified version of Barany's rotary test (10 revolutions in 10 sec) under conditions of horizontal flight in a jet airplane and under conditions of brief weightlessness (25 sec). The vestibular analyzer was studied with respect to three basic components: somatic (duration of postnystagmus), vegetative (pulse rate, sweatiness, skin coloring), and sensory (subjective sensations, illusion of counterrotation). It was found that under these conditions 18.2% of the test subjects had a latent form of motion sickness. In the second stage of the test, in which subjects experienced transition from overloads to weightlessness, an additional 22.2% of the subjects demonstrated symptoms of motion sickness. Causes for motion sickness under both test conditions are proposed. L.E.W.

N67-11549# Joint Publications Research Service, Washington, D. C.

FURTHER DEVELOPMENT OF THE OTOLITHIC THEORY OF MOTION SICKNESS

G. L. Komendantov, V. S. Kompanets, V. I. Kompanev, S. I. Poleshchuk, N. A. Razsolov et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 280–281 refs (See N67-11401 02-04) CFSTI: $8.40

The main points of the otolithic theory of motion sickness are briefly delineated, and recent developments in this theory are summarized. From an investigation of these papers the following data were established: (1) the presence of phases in the development of motion sickness, (2) fluctuation of functions, whose amplitude depends on the phase of development, (3) disturbance of the functional systemic state as an additional mechanism of motion sickness, (4) occurrence of the illusion of rocking and corresponding compensatory motor reactions, (5) specific nature of the course of motion sickness at altitudes of 2000, 3000, 4000, and 5000 m, (6) change of the excitability and lability of the visual analyzer in the latent form of motion sickness, (7) changes of atrioventricular conductivity during the various phases, (8) influence of dibazol on latent motion sickness, and (9) inhibition of lift reflexes in the case of prolonged standard rocking of animals and the restoration of these reflexes on change of the rocking regime, and the possibility of using motion sickness to detect latent functional deficiencies. L.E.W.

N67-11550# Joint Publications Research Service, Washington, D. C.

THE COMBINED ACTION OF ACCELERATION AND IONIZING RADIATION ON THE ORGANISM OF ANIMALS

N. I. Konnova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 282 (See N67-11401 02-04) CFSTI: $8.40

The combined influence of acceleration and ionizing radiation on mice, rats, and dogs was evaluated on the basis of mortality, length of life of the test animals, body weight, and peripheral blood. In the tests on mice, it was found that centrifuging both before and after a 600 R gamma ray dose increases the survivability of the animals by 8% to 12%. In the experiments on rats there were no statistically reliable differences in tests of survival and average length of life between the test and control groups. Testing of the dogs established that in the animals subjected to the combined action of acceleration and irradiation, leucopenia was more pronounced. L.E.W.

N67-11551# Joint Publications Research Service, Washington, D. C.

THE RADIATION SENSITIVITY OF WHITE RATS UNDER CONDITIONS OF HYPOTHERMIA

L. G. Kon'kova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 283–284 (See N67-11401 02-04) CFSTI: $8.40

A comparison of the radiation sensitivity of white rats irradiated in a state of hypothermia and at normal body temperature was made on the basis of genital system and fertility, peripheral blood, and change of weight. The following results were indicated: (1) The sexual cycle of rats irradiated in a state of hypothermia occurred without significant deviation from the norm; however, rats irradiated at normal body temperature exhibited serious disturbances during the course of the extra cycle appearing as a prolongation of the stage of diestrus and decrease in the number of normal cycles. (2) In respect to fertility, it was found that females subjected to irradiation in the state of hypothermia and mated with nonirradiated males produced vital progeny, which did not occur in females irradiated at normal body temperatures. (3) Changes in peripheral blood were more weakly expressed in animals irradiated in the state of hypothermia. L.E.W.

N67-11552# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF VIBRATION ON THE HUMAN ORGANISM

A. A. Koreshkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 285 (See N67-11401 02-04) CFSTI: $8.40

Data from an experimental study of the influence of general vertical vibrations with a frequency of 50 cycles and an amplitude of oscillation of 0.5 mm during the course of 1 hr on the organism of a healthy human being are mentioned. L.E.W.

N67-11553# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF BRIEF INTENSIVE LIGHT FLASHES ON ADAPTATION TO DARKNESS AND ON VISUAL ACUITY

P. A. Korzun *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 286–287 refs (See N67-11401 02-04) CFSTI: $8.40

The effect of the color nature of brief intensive flashes on light sensitivity and visual acuity of the human eye was examined. The flashes were produced with an impulse lamp, and red, blue, and green flashes were obtained with the use of filters. The following patterns were established: (1) After brief intensive illumination of the periphery of the retina with blue and green flashes, light sensitivity was reduced by 5 to 30 times, and the duration of this reduction varied from 15 to 30 min. (2) After illumination of the retina with red flashes, the light sensitivity was the same as after readaptation. (3) In the case of illumination of the macular area of the retina the light sensitivity is restored just as quickly as after readaptation to the sphere. (4) Visual acuity is reduced the least and returns most quickly to the initial level after illumination with flashes of blue light. L.E.W.

N67-11554# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF THE ADAPTATION OF THE HUMAN ORGANISM UNDER CONDITIONS OF PROLONGED SPACE FLIGHT

A. V. Korobkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 288–289 (See N67-11401 02-04) CFSTI: $8.40

Various aspects of simulating the conditions of prolonged space flight and its effects on the human body are summarized. It is noted that adaptation to hypodynamia and hyperdynamia is characterized by a series of general shifts in the endocrine system, the resistance of capillaries, and other reactions. Four stages of adaptation to prolonged space flight are delineated, and characteristics of adaptation during the first stage are briefly reported. Investigation of changes of the functional condition of persons with varying degrees of physical training showed an adjustment of the control of movements in persons with a high level of physical training. It is pointed out that the most important condition for the expansion of human possibilities for active actions under these conditions is a properly organized regime of motor and psychic activity with the use of food, pharmacology, and other factors in preliminary training, during the space flight, and during the restorational period. L.E.W.

N67-11556# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE INFLUENCE OF CHANGES OF SENSORY LOADS UNDER FLIGHT CONDITIONS

F. P. Kosmolinskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 292 (See N67-11401 02-04) CFSTI: $8.40

Various aspects of simulating prolonged space flight conditions and the effect of changes of psychophysiological sensory loads on the human organism are briefly considered. It is pointed out that among the factors affecting the human body would be the situational ones, e.g., social isolation, monotony, and sensory deprivation. A method of investigating the alternating effect of reduced and increased afference under conditions of complex aviation flights is also mentioned. L.E.W.

N67-11557# Joint Publications Research Service, Washington, D. C.

CAMPIMETRIC INVESTIGATIONS OF MAN UNDER PROLONGED ACCELERATIONS

E. S. Kotova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 293 refs (See N66-11401 02-04) CFSTI: $8.40

The effects of subjection to repeated action of transverse accelerations of various magnitudes on the dimensions of the human blind spot are reported. Measurements of the dimensions of the blind spot indicated that the blind spot expands at 38 to 50 min after stopping the centrifuge. The restoration of normal boundaries of the blind spot occurred at 28 to 36 hr after the experiment; the restoration of the angioscotomas corresponded to the times of restoration of the normal size of the vessels at 5 to 8 to 11 days. It was concluded that increase of the scotoma of a blind spot and of angioscotomas could be a result of local hemocirculatory disturbances of the retinal vessels and of hemodynamic shifts in the vascular system of the brain. L.E.W.

N67-11558# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE FUNCTIONAL CONDITION OF THE TEMPERATURE AND AUDITORY ANALYZERS UNDER CONDITIONS OF HIGH AIR TEMPERATURE

N. A. Kokhanova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 294–295 refs (See N67-11401 02-04) CFSTI: $8.40

The latent time of human sensory–motor reaction to heat and sound stimuli under conditions of high air temperature was investigated. Test details are briefly outlined. The data indicated that a decrease of the latent reaction to heat stimulation indicated an increase of the functional mobility of the temperature analyzer, which is combined with a simultaneous lowering of the functional mobility of the auditory analyzer. This was manifested by an increase of the latent time of the auditory reaction. L.E.W.

N67-11559# Joint Publications Research Service, Washington, D. C.

THE NEGATIVE INFLUENCE OF RADIATION-PROTECTIVE PREPARATIONS ON THE MOTOR-EVACUATORY FUNCTIONING OF THE GASTROINTESTINAL TRACT

I. G. Krasnykh and A. R. Mansurova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 296–297 (See N67-11401 02-04) CFSTI: $8.40

The effects of cystamine, S_1, β-aminoethylisothiuronium, cystaphos, and maxamine on the motor-evacuatory functioning of the gastrointestinal tract of nonirradiated rats were assessed. The radiation-protective preparations were administered intraperitoneally, orally, and rectally. Observations conducted using X-ray methods and a contrasting substance, barium sulfate, indicated the following: (1) These preparations retard the evacuation of the contrasting mass from the stomach by 4 to 8, 3 to 6, and 2 to 3 times depending on administration by mouth, intraperitoneally, and rectally. (2) The protective agents cause a prolonged spasm of the pylorus and the prepyloric part of the stomach and also a phase disturbance of the tonus and peristalsis. (3) The preparations cause spasm and strengthening of the tonus of the cranial loops of the small intestine during the first hours and symptoms of dystonia of the entire intestine during later hours. (4) The lowering of the preparations' effect in the case of oral administration is connected with disruption of evacuation from the stomach and consequently with retardation of their absorption. L.E.W.

N67-11580# Joint Publications Research Service, Washington, D. C.

THE ELIMINATION OF CERTAIN CONSEQUENCES OF EXTREME EFFECTS OF STEP-BY-STEP ACCLIMATIZATION TO A HIGH ALTITUDE CLIMATE

A. N. Krasyuk, N. V. Kol'chenko, and S. I. Moldavskaya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 298–299 (See N67-11401 02-04) CFSTI: $8.40

The effect of step-by-step acclimatization to a high altitude climate on the organism of persons with symptoms of the effects of small doses of ionizing radiation was assessed. The testing was conducted at altitudes of 2100, 3000, 3400, and 3700 m above sea level. The main tests conducted concerned the idices of the peripheral blood, oxyhemography, mobility of the nervous processes, and working ability of the cortical cells of the brain. It was concluded that step-by-step acclimatization has a favorable effect on hemopoiesis, the vascular system, the mobility of the nervous processes, and the working ability of the cortical cells of the brain of test subjects. L.E.W.

N67-11561# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF INCREASED AND REDUCED TEMPERATURES IN A CHAMBER ON THE MENTAL WORKING ABILITY AND PHYSICAL FUNCTIONING OF TEST SUBJECTS

Ye. M. Krutova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 300–301 (See N66-11401 02-04) CFSTI: $8.40

The influence of chamber temperatures on the mental ability and psychic functioning is considered. Attempts were made to discern the effect of increased temperature (40°C) and humidity (70–78%) and reduced temperature (0°, −10°C) and humidity (40–60%) on test subjects' memory, thinking, and attention. It was concluded that under conditions of increased temperature and humidity there is a worsening of mental ability. Under conditions of reduced temperature and normal humidity, there is a fluctuation of mental working ability in accordance with the cooling of the body. S.P.

N67-11562# Joint Publications Research Service, Washington, D. C.

THE STATE OF THE FUNCTIONING OF THE AUDITORY ANALYZER UPON THE PROLONGED ACTION ON THE HUMAN ORGANISM OF SMALL MAGNITUDES OF CORIOLIS ACCELERATIONS

Yu. V. Krylov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 302–303 (See N67-11401 02-04) CFSTI: $8.40

Human auditory functioning under prolonged action of Coriolis accelerations is examined. A 24-hr exposure resulted in fluctuations of auditory sensitivity on the order of 10.0–12.5 decibels. In the case of 24-hr continuous rotation at an angular velocity of 10.6°/sec and 21.2°/sec, there was a fluctuation of auditory sensitivity that reached 15–25 decibels. S.P.

N67-11563# Joint Publications Research Service, Washington, D. C.

A METHOD OF IRRADIATING BIOLOGICAL OBJECTS WITH A MULTIPLY CHARGED ION ACCELERATOR

Ye. I. Kudryashov, A. M. Marennyy, V. I. Popov, A. I. Portman, B. I. Solyanov, et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 304–305 (See N67-11401 02-04) CFSTI: $8.40

Irradiation experiments were conducted on tissue and plant cultures using multichared ion accelerators to aid in calculating the total dose received by astronauts and a biocomplex during prolonged space flight. When the thickness of the biological objects did not exceed 5 to 10 microns, the dose absorbed by the biological object was calculated according to the ionization losses in polyethylene, which is close in its inhibiting ability to moist tissue. S.P.

N67-11564# Joint Publications Research Service, Washington, D. C.

EXPERIMENTAL INVESTIGATION OF THE EFFECTIVENESS OF LOCAL PROTECTION

R. A. Kuzin, G. F. Nevskaya, V. I. Popov, M. A. Sychkov, A. V. Shefirkin, et al *In its* Prob. in Aerospace Med. 21 Oct. 1966 p 306–307 (See N67-11401 02-04) CFSTI: $8.40

A method is described for arranging radiobiological experiments to study the effectiveness of local protection. The desired conditions for the experiments are listed. Paraffin was selected as the shielding material. By describing the results of an experiment, it is shown that the method proposed is adequate. H.S.W.

N67-11565# Joint Publications Research Service, Washington, D. C.

THE USE OF SYNTHETIC PREPARATIONS FOR INCREASING THE HEAT RESISTANCE OF AN ANIMAL ORGANISM

Ye. I. Kuznets *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 308–309 (See N67-11401 02-04) CFSTI: $8.40

The process which increases the amount of heat that an animal's body may tolerate is explained. The process involves the use of synthetic antioxidizing agents which retard heat production. From tests on white mice, it was learned that the possibility exists of using biogenic amine–indolilalkylamines as thermal protectors for increasing the heat resistance of an organism. H.S.W.

N67-11566# Joint Publications Research Service, Washington, D. C.

SOME ASPECTS OF THE REACTION OF AN ORGANISM TO THE EFFECTS OF THE SOUND IMPULSES OF PRESSURE

V. S. Kuznetsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 310–311 (See N67-11566 02-04) CFSTI: $8.40

The boom of a supersonic aircraft was imitated by sound shocks to determine the degree of discomfort as indicated by the response reaction of an organism. Changes in the electrical activity of the cerebral cortex according to the data of an electroencephalogram were investigated. Vegetative reactions including pulse rate, respiratory rate, and the cutaneous galvanic reflex were studied. In addition to recording physiological functions the psychophysiological sensations of the test subjects were considered in determining the discomfort from shock impulses of pressure. S.P.

N67-11567# Joint Publications Research Service, Washington, D. C.

SOUND CHAMBER TESTS AS A METHOD OF STUDYING THE INDIVIDUAL-PSYCHOLOGICAL ASPECTS OF PERSONALITY

O. N. Kuznetsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 312–313 (See N67-11401 02-04) CFSTI: $8.40

Sound chamber studies of man's personality during solitary confinement are described. The advantages of this method are enumerated and termed useful in solving problems of engineering psychology and astronautics. S.P.

N67-11568# Joint Publications Research Service Washington, D. C.

ENERGY CAPACITY OF PHYSICO-CHEMICAL METHODS OF MINERALIZATION OF THE PRODUCTS OF THE VITAL ACTIVITY OF MAN

S. O. Kuznetsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 314–315 (See N67-11401 02-04) CFSTI: $8.40

Physico-chemical methods of mineralization such as thermal combustion, wet combustion, and catalytic oxidation are evaluated. The energy requirements of all three methods are compared for cases of treating feces and less concentrated waste products. In the case of energy requirements conclusions were that it is best to process solid waste using the thermal method and use the catalytic method or wet combustion for less concentrated waste products. S.P.

N67-11569# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE METHOD OF "APPLICATION" OF STRICT SENSORY DEPRIVATION DURING PROLONGED SOUND CHAMBER TESTS

O. N. Kuznetsov, V. I. Lsoedev, and A. N. Litsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 316–317 refs (See N67-11401 02-04) CFSTI: $8.40

The events leading to the selection of a method for the study of sensory deprivation are discussed. It was found that during a period of nine hours of regulated sleep, the test subjects slept for only seven hours, and spent the remainder of the time lying in a horizontal position in darkness with sharp restriction of movement. The hours of sleeplessness during the prolonged sound chamber tests are considered good simulation conditions for investigating strict sensory deprivation against a background of relative deprivation. The use of this technique in astronaut training is mentioned. H.S.W.

N67-11570# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF A CATALYTIC METHOD OF MINERALIZATION OF THE PRODUCTS OF THE VITAL ACTIVITY OF MAN

S. O. Kuznetsov, Yu. Ye. Sinyak, and I. L. Shul'gina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 318–319 (See N67-11401 02-04) CFSTI: $8.40

The oxidation of waste directly on a catalyst, and pyrolysis of waste with subsequent oxidation of the products on a catalyst were the two methods investigated. It was found that the second method has the advantage that it eliminates the problem of removing the inorganic residue from the surface of the catalyst. The conclusions drawn from the investigations are listed. H.S.W.

N67-11571# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF THE COMPLEX ACTION OF MULTIPLE VIBRATION AND FRACTIONATED IRRADIATION ON THE STATE OF THE ARCH OF THE SPINE-BRAIN REACTION

M. A. Kuznetsova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 320 (See N67-11401 02-04) CFSTI: $8.40

The results from the tests are given. It was found that the vertical vibration caused the development of parabiotic inhibition in the reflex arch. The radiation caused an increase in the latent periods of reaction to weak irritants, and a decrease in the reaction period for strong irritants. Animals subjected to both vibration and radiation reacted either in a manner similar to the vibrated animals, or in the same manner as the irradiated animals. H.S.W.

N67-11572# Joint Publications Research Service, Washington, D. C.

QUESTIONS OF THE WORK AND REST REGIME OF CIVIL AVIATION FLIGHT PERSONNEL

D. S. Kuleshov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 321 (See N67-11401 02-04) CFSTI: $8.40

The improvements made in the operating conditions for the pilots of modern, high performance aircraft are noted. It is further noted that a scientific regime of work and relaxation for crew members is necessary because of longer missions and longer flying hours. An analysis of this problem is recommended; however, it is inferred that this analysis is beyond the framework of the capabilities of medical personnel. H.S.W.

N67-11573# Joint Publications Research Service, Washington, D. C.

THE STUDY OF THE NATURE OF CHANGES OF THE FUNCTIONAL STATE OF THE SKIN UNDER CONDITIONS OF ITS NATURAL CONTAMINATION

L. M. Kurilova and S. I. Sidorkina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 323–324 (See N67-11401 02-04) CFSTI: $8.40

Observations of the facial skin changes were made on subjects in an enclosed chamber. Physiological indexes used were skin temperature, heat radiation of the skin, and changes in functional adjustment of the thermal receptors on the cheeks under reflective temperature influence. S.P.

N67-11574# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE INFLUENCE ON AN ORGANISM OF PROLONGED RESTRICTION OF MOBILITY AND WAYS TO COMPENSATE FOR IT BY PHYSICAL EXERCISES

B. A. Lampusov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 325–326 (See N67-11401 02-04) CFSTI: $8.40

The effect of hypokinesis on the motor sphere during conditions of restricted mobility is considered, and compensation through physical exercise is examined. Of the subjects tested, the magnitude and character of the negative physiological shifts depended on the amount of motor activity and magnitude of physical loads in their professional work. The strength and tonus of the muscles, cardiac activity, and respiratory functioning were affected. S.P.

N67-11575# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF IMMUNIZATION ON THE RESISTANCE OF AN ORGANISM TO THE RADIATION FACTOR OF SPACE FLIGHT

K. A. Lebedev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 326–328 (See N67-11401 02-04) CFSTI: $8.40

The lymphoid tissue of irradiated rabbits which were immunized before irradiation, were studied to investigate the mechanisms involved in the protective action of various antigenic agents. After irradiation, it was shown that there was destruction in the multiplication centers of the secondary follicles in the lymph nodes. In studying the antibody-containing cells, it was found that after irradiation the number of these cells increased in the same manner as in nonirradiated immunized rabits. The radiation resistance of the actively multiplying hemocytoblasts is thought to be the reason for the accelerated regeneration of lymphoid tissue. H.S.W.

N67-11576# Joint Publications Research Service, Washington, D. C.

THE CONVEYER SYSTEM IN THE LINK OF HIGHER PLANTS

Ya. V. Lebedeva, L. V. Dmitriyeva, and A. V. Malinovskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 329 (See N67-11401 02-04) CFSTI: $8.40

The growth of plants in a closed ecological system is discussed briefly. Two methods of growing plants are mentioned: aeroponics and hydroponics. Experiments in plant growth using hydroponics showed that it is possible to obtain fresh vegetables in quantities to provide a calculated daily ration; the vitamin content in the plants is normal; and the productivity of plants in a conveyer may be increased by regulating the parameters of the ecological complex. H.S.W.

N67-11577# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE PSYCHOLOGICAL BASES OF THE INDIVIDUALIZATION OF PHYSICAL TRAINING

B. V. Lagon'kov, Yu. A. Surinov, O. N. Kuznetsov, and V. I. Lebedev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 330–331 (See N67-11401 02-04) CFSTI: $8.40

A method for studying the psychological aspects of individual physical training is described. Astronauts are subject to various training exercises; and such processes as thought, attention, and memory are determined. Physical training is divided into two stages; first, conversation and passive observation and second, individual training and experimentation. S.P.

N67-11578# Joint Publications Research Service, Washington, D. C.

THE ROLE OF THE CENTRAL CHOLINOREACTIVE AND ADRENOREACTIVE SYSTEMS IN THE REGULATION OF VESTIBULAR REACTIONS

I. I. Leshchinyuk *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 332–333 (See N67-11401 02-04) CFSTI: $8.40

The roles of cholinoreactive, and adrenoreactive systems in regulating vestibular reactions are examined. A study was made of such parameters of rotary nystagmus as duration, number of strokes, frequency, amplitude, and energy. Results showed that blockage of the central M- and N-cholinoreactive systems caused a sharp reduction of all these parameters except frequency, which did not change significantly. In contrast to the central cholinolytic agents, aminazine increased the duration, number of strokes and frequency, while reducing the amplitude and not changing the energy of nystagmus. Data showed that cholinoreactive and adrenoreactive systems do not play the same role in regulating vestibular-motor reactions. S.P.

N67-11579# Joint Publications Research Service, Washington, D. C.

THE COMBINED ACTION OF VIBRATION AND IONIZING RADIATION ON THE METABOLISM AND FUNCTIONING OF THE CENTRAL NERVOUS SYSTEM

N. N. Livshits, Z. I. Apanasenko, M. A. Kuznetsova, L. D. Luk'yanova, and Ye. S. Meyzerov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 334–335 (See N67-11401 02-04) CFSTI: $8.40

The complex action of vibration before and after irradiation in lethal doses is considered with respect to oxidative processes, vestibular reflexes, and bioelectric activity of the skeletal muscles. Mechanisms contributing to this action are the oxygen effect, change in the central nervous system, nerve center interaction, and the course of repair and compensatory processes. S.P.

N67-11580# Joint Publications Research Service, Washington, D. C.

THE COMPLEX ACTION OF VIBRATION AND IONIZING RADIATION ON THE CONDITIONED REFLEX ACTIVITY OF RATS

N. N. Livshits and Ye. S. Meyzerov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 336–337 (See N67-11401 02-04) CFSTI: $8.40

Investigations of the complex action of vibration and radiation on the nervous system are reported. It was demonstrated that under the influence of vibration, significant changes occur in effects of radiation on the oxidative metabolism of the brain and on the conditioned reflex activity of animals. S.P.

N67-11582# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE BIOLOGICAL EFFECT OF COMBINED X-RAY AND SUPERHIGH- FREQUENCY RADIATION

A. Ya. Loshak *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 340–341 (See N67-11401 02-04) CFSTI: $8.40

The effect of decimetric radio waves of low intensity and the effect of total and local ionizing radiation on the survivability of rats after x-ray irradiation with a lethal dose of 100/30 was studied. The purpose of the study was to examine the degree of sensitivity of rats to the subsequent action of lethal doses of ionizing radiation, and to determine the possibility of increasing the radiation resistance of the organism. Results of the experiment did not show the presence of a protective effect of preliminary microwave irradiation, and it was not possible to establish differences in the survival of rats subjected to general or local (head) effects of superhigh frequency energy. Data indicated a considerable reduction in the resistance of rats to the combined effect of decimetric radio waves of low intensity and of ionizing radiation. This phenomenon is attributed to the single direction of the morphological and functional changes in the organs and tissues, particularly in the hemopoietic system, occurring under the influence of the electromagnetic fields of the decimetric range and of X-rays. The less expressed biological effect of the superhigh frequency irradiation of the head of the rats was connected with the absence of the direct effect of microwaves on the hemopoietic organs, especially on the bone marrow. S.C.W.

N67-11584# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF HISTAMINE AND ANTIHISTAMINE AGENTS ON THE RESISTANCE OF ANIMALS TO THE EFFECTS OF A RAREFIED ATMOSPHERE AND FACTORS OF A CLOSED SPACE

P. I. Lukiyenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 343–344 (See N67-11401 02-04) CFSTI: $8.40

The effectiveness of histamine and antihistamine preparations in preventing hypoxia was studied using white mice and rats as test animals. Experiments were conducted in a barometric chamber and a closed vessel. In the barometric chamber, the activity of the preparations was determined at altitudes at which all the test animals perished. The preparations were administered one time under the skin in various doses 60 minutes before ascent. The effectiveness of these preparations was evaluated using a protective index which was calculated by dividing the 50% lethal dose by the 50% protective dose. The duration of life served as the protective index in a closed container. Preparations were administered 60 minutes before the test in doses which were most effective under barometric chamber conditions. It was established that histamine and antihistamine compounds in certain doses increased the resistance of animals to hypoxia. S.C.W.

N67-11585# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE INTERRELATION BETWEEN THE FUNCTION ACTIVITY OF THE BRAIN AND ITS OXIDIZING METABOLISM UPON THE ACTION OF A VIBRATION STIMULUS

L. D. Luk'yanova, Ye. P. Kazanskaya, A. V. Kol'tsova, and Ye. S. Meyzerov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 345–346 (See N67-11401 02-04) CFSTI: $8.40

The influence of vibrational stimuli on functional interrelationships between the brain and central nervous system, and the consumption of oxygen in sensory-motor and visual areas of the cerebral cortex; was studied. Reported are results of observations of EEG's of laboratory animals after subjection to short period (interrupted) and multiple (uninterrupted) vibrational stimuli. S.C.W.

N67-11586# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF VIBRATION ON THE COURSE AND OUTCOME OF RADIATION INJURY IN ANIMALS

T. S. L'vova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 347–348 (See N67-11401 02-04) CFSTI: $8.40

Tests were conducted on mice and dogs to determine the relationship between the frequency of vibration, radiation dose, and time between exposures on the occurrence and degree of radiation injury. In tests on mice it was established that the preliminary action of vibration with a frequency of 700 hertz at four hours and one day before irradiation reduced mortality rates by 10 to 20% and increased the average life span of the animals which subsequently died by 10 to 40%. The preliminary action of vibration five days before irradiation increased mortality rates and reduced the average life span of these animals. The application of vibration every four hours for one day and five days after irradiation reduced mortality rates by 15 to 38% and increased the average life span of the animals which eventually died. The preliminary action of vibration after one hour did not influence the course or outcome of radiation injury. Radiation sickness was intensified when a vibrational frequency of 700 hertz was applied after irradiation. Studies of hematological indices of dogs irradiated at two hours or one day after vibration showed that the quantity of leucocytes and erythrocytes was higher than that of control animals. No persistent and expressed shifts were observed with respect to leucocytic number. S.C.W.

N67-11587# Joint Publications Research Service, Washington, D. C.

TISSUE RESPIRATION DURING THE ACTION OF LONGITUDINAL LOADS

E. S. Maslyan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 349–350 (See N67-11401 02-04) CFSTI: $8.40

Tissue respiration under conditions of increased gravitation was studied in an effort to determine the nature of developing disorders and possible methods for preventing changes associated with oxygen starvation. Experiments were conducted on white rats which had been subjected to longitudinal positive loads having magnitudes of 6, 13, and 20 to 26 g's for two minutes. A study of tissue respiration of the brain (large hemispheres), heart, liver, and muscle of the diaphragm was conducted using a Warburg apparatus in an atmosphere of 100% O_2 and in a hypoxic mixture (11% O_2+89% N_2). Results showed that loads of 6 and 13 g's caused slight changes in the intensity of respiration in all tissues studied. With extreme loads of 26 g's, the intensity of respiration of all tissues except the heart was lower in animals which survived. In establishing the respiration patterns of tissues in an atmosphere consisting of the hypoxic mixture, it was also found that there was a certain pattern in changes of tissue respiration intensity. It was established that temporary parameters of load action play an important role in disturbances of tissue respiration and that increased disturbances depend upon load magnitude. S.C.W.

N67-11588# Joint Publications Research Service, Washington, D. C.

THE MECHANISM OF ADAPTATION TO HYPOXIA

V. B. Malkin, I. D. Bogacheva, V. K. Martens, and N. A. Roshchina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 351–352 (See N67-11401 02-04) CFSTI: $8.40

The role of the adrenal glands, the hypophysis, and the cortex of the large hemispheres of the brain in the development of the adaptation syndrome in mammals subjected to prolonged conditions of reduced barometric pressure was studied. Tests were conducted on mature white rats and the following was determined: the adaptation of the animals to altitude after hypophysectomy, adrenalectomy, and the removal of the cortex. Indices of adaptation were weight, red blood count shifts, and resistance to acute hypoxia. In animals which were adapted to altitude there was a noticeable decrease in the growth rate. This was sharply expressed in intact animals and less expressed in animals which had adrenalectomy or the cortex removed. The difference in weight of animals which had hypophysectomy was slight. Control animals gained almost no weight. After prolonged stay under conditions of reduced atmospheric pressure the intact rats, those having adrenalectomy, and those with the cortex removed showed an increase in the amount of erythrocytes, reticulocytes, and hemoglobin in peripheral blood. In all groups of test animals, both after a stay in a mountainous (simulated) altitude and after adaptation in a barometric chamber, there was an increase in resistance to acute hypoxia. Experiments showed that removal of the hypophysis the adrenal glands, or the cortex, does not preclude the development of adaptation to hypoxia. S.C.W.

N67-11589# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF DISTURBANCES OF LIPOID EXCHANGE IN DOGS UNDER THE INFLUENCE OF RADIAL ACCELERATIONS

M. S. Martsevich and V. Ye. Potkin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 353–354 (See N67-11401 02-04) CFSTI: $8.40

The role of the small intestine in regulating the level of cholesterol in the blood after radial acceleration was studied. Isolated sections of the small intestine of dogs were prepared and the content of cholesterol in the blood and intestinal juice was determined before and after acceleration. On the day of the initial test it was established that the action of transversely directed radial accelerations caused an increase in the concentration of cholesterol in the blood and a lowering of cholesterol in intestinal juice. After two months (period of aftereffects) it was established that the increase in cholesterol in the blood was connected with a change of its secretion with intestinal juice. On the basis of these findings, the influence of radial accelerations after the addition of a large quantity of cholesterol to the food of the animals was studied. It was found that after an experimental cholesterol diet, the effect of accelerations caused an increase of cholesterol in the blood and a lowering of cholesterol secretion in the intestinal juices. During the period of aftereffects, the concentration of cholesterol in the blood was at a higher level in those animals fed the experimental cholesterol diet. Results demonstrated that the small intestine takes part in regulating the level of cholesterol in the blood under the influence of radial accelerations. S.C.W.

N67-11590# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF THE PARTICIPATION OF THE SYMPATHICOADRENALIN SYSTEM IN THE FORMATION OF COMPENSATORY REACTIONS IN RABBITS TO CHANGED ENVIRONMENTAL CONDITIONS

A. F. Maslova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 355 (See N67-11401 02-04) CFSTI: $8.40

Rabbits were confined to a hermetically closed environment in order to determine the role of the sympathetic-adrenal system in the formation of adaptational reactions to changing environmental conditions. The action of the environment on the functional state of the nervous system resulted in the secretion of large quantities of adrenalin and acetylcholine in the blood. The first two hours of isolation were the most severe and during this period large amounts of catecholamines were required. After prolonged isolation a relationship developed between the organism and the environment which provided the conditions necessary for the secretion of noradrenalin which was vital to the formation of an adaptational reaction. Results were in agreement with a previous hypothesis that a certain time is required for the formation of an adaptational reaction by the nervous system. Experiments showed that readjustment of the organism to changed environmental conditions occurred during the first six hours. S.C.W.

N67-11591# Joint Publications Research Service, Washington, D. C.

COMPARATIVE STUDY OF THE CYTOGENETIC EFFECT OF PROTONS WITH AN ENERGY OF 630 MEV AND OF THE GAMMA RADIATION OF COBALT-60

V. M. Mastryukova and A. D. Strzhizhovskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 356–357 (See N67-11401 02-04) CFSTI: $8.40

Corneal epithelium of mice was subjected to irradiation with 630 mev protons and gamma radiation of Co^{60} to determine the damaging effects of high energy protons on tissue regeneration. Irradiation with 630 mev protons in doses of 100, 200, 700, and 1000 rad caused reversible suppression of mitotic activity in corneal epithelium. The intensity of mitotic activity restoration decreased with an increase in radiation dosage. The quantity of cells with chromosomal aberrations increased exponentially with an increase in dosage. The average effective dose was 560 rad. Damage to cell genetic structure sharply suppressed cell reproduction and resulted in the formation of pathological mitoses shortly after irradiation. Classification of chromosomal aberrations by types aided in establishing a correlation between the degree of suppression of cell reproducibility and the type of chromosomal aberration. Studies of the effects of Co^{60} yielded significant data on the nature of mitotic activity restoration and the distribution of chromosomal aberrations related to intracellular reparation and radiation effects. The relative biological effectiveness of 630 mev protons, as compared with gamma radiation of Co^{60} was 0.7. S.C.W.

N67-11592# Joint Publications Research Service, Washington, D. C.

THE RELATION OF THE BIOELECTRIC ACTIVITY OF THE MUSCLES, THE OXYGEN CONSUMPTION, AND THE TEMPERATURE OF WHITE RATS DURING HYPER-GRAVITATION

V. V. Matsynin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 358–359 (See N67-11401 02-04) CFSTI: $8.40

Rats were subjected to transversely directed accelerations of 3, 5, 10, 20, 30, and 40 g's for 3 to 5 minutes to determine the relationship of the bioelectric activity of external oblique abdominal muscles, oxygen consumption, and body temperature. The primary objectives of the study was to assess the role of these indices in energy exchange and heat production. No relationship between these three factors could be established. It was found that the lowering of body temperature which began during the period of acceleration also continued during the post-gravitational period even when the bioelectric activity of the muscles and oxygen consumption remained at a level which was higher than initial levels. It is surmised that under conditions of an overload there is a divergence between the expected and actual heat formation. The cause of this divergence is attributed to a disruption of the mechanisms of heat formation. S.C.W.

N67-11594# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF A SOUND SHOCK ON CERTAIN HUMORAL-ENDOCRINE OF THE HUMAN ORGANISM

B. M. Mirzoyev, Yu. I. Milov, and O. A. Vorovets *In its* Probl. in Med. 21 Oct. 1966 p 362–363 (See N67-11401 02-04) CFSTI: $8.40

Physiological studies with an imitated sound shock (clap) were conducted to study the cumulative effect of pulse noise under laboratory conditions. Two series of tests were conducted. Subjects in both series were subjected each day for five to six days to the influence of sound shock of an intensity of 7–7.5 kg/m^2 (first series) and 9–9.5 kg/m^2 (second series) with a 10 to 15 minute interval at the same time of the day. A series of physiological reactions (EEG, EKG, blood pressure, etc.) was recorded prior to and at 1, 5, and 10 minutes after each sound shock. An analysis was also made of the blood sugar and urine before and after the test. The blood sugar was checked for sugar and corticosteroids; the urine was checked for adrenalin, noradrenalin, creatinine, potassium, sodium, and the extent of diuresis. Tests showed that all indices did not change significantly under the influence of a sound shock; however, reliable shifts in diuresis and the excretion of sodium and creatinine in the first series with a lesser intensity of sound shock were more pronounced than in the second series. Results of corticosteroid analyses indicated that a sound shock of a certain intensity can activate the hypophyseal-adrenal system and have an unfavourable effect on the organism. S.C.W.

N67-11595# Joint Publications Research Service, Washington, D. C.

SOME ASPECTS OF THE INFLUENCE ON AN ORGANISM OF THE SHOCK LOADS OF LANDING

G. P. Mirolyubov, N. I. Frolov, and N. P. Morozova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 364–365 (See N67-11401 02-04) CFSTI: $8.40

The systemic effects of shock loads on rats and dogs were studied to determine the possible characteristics of these loads during emergency landings of spacecraft. Focused upon were the damaging effects of shock loads on parenchymatous organs, organs filled with air (pulmonary alveoli and the abdominal cavity), and organs filled with liquid (gastrointestinal tract, vena cava, etc.). Tolerance of landing loads was strongly related to the application of additional overloads occurring upon vibration of the falling platform and the supporting surface at the moment of impact. Upon landing, the animals perished at a rate of 6 meters/sec, whereas after the elimination of additional overloads, they were able to tolerate landing at a rate of 14 meters/sec without injury. Damaging effects of shock loads on organs containing air were directed within the organ, whereas damage to parenchymatous organs was induced by externally applied forces. Changes of arterial pressure, pulse rate, and respiration were observed along with damage to internal organs. The repeated application of shock overloads which were not damaging caused a decrease in tolerance. It was further found that the cumulative nature of the effects of shock overloads depended on the intensity of the effect (frequency of the applied effects and magnitude of the overloads) and on the degree of disturbances affecting functional regulation and adaptation. S.C.W.

N67-11596# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF RADIATION-PROTECTIVE PREPARATIONS ON THE FUNCTIONAL STATE OF THE HUMAN ORGANISM

A. S. Mozzhukhin, V. I. Kuznetsov, M. S. Kuzhakovskaya, O. K. Makhalova, I. A. Goryachev et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 366 (See N67-11401 02-04) CFSTI: $8.40

It is reported that a study was made of the influence of cysteamine on the functional state of the human organism. It was found that the preparation does not cause significant changes in

working ability or the functional state of the cardiovascular, respiratory, digestive, excretory, and nervous systems. C.T.C.

N67-11597# Joint Publications Research Service, Washington, D. C.

THE STUDY OF HEMODYNAMIC FUNCTIONING OF THE HEART BY INSTRUMENTAL METHODS DURING HYPOXIC HYPOXIA

V. M. Murayenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p (See N67-11401 02-04) CFSTI: $8.40

A study is reported in which 126 persons were examined to determine the functional condition of the heart on a valvular, muscular, and mechanical phenomena basis. Also studied was the reaction of the myocardium during the cardiac cycle. The frequency of systoles, an arterial oscillogram, and a ballistocardiogram were recorded under ordinary conditions and at a simulated altitude of 5000 meters. A polycardiographic method of recording was used to determine the duration of the phases and periods of cardiac contraction. Among the conclusions are that the changes of phases and periods of the cardiac cycle in the case of hypoxia in healthy persons consists of a shortening of their duration, and that all test subjects showed an increase in the amplitudes of the waves of the systolic complex at the 5000 meter altitude. C.T.C.

N67-11598# Joint Publications Research Service, Washington, D. C.

A METHOD OF CHRONIC SOUNDING OF THE ARTERIAL VASCULAR CANAL

A. N. Nazin, O. D. Anashkin, Ye. N. Zhuravleva, V. K. Podymov, and N. A. Maslova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 369–370 (See N67-11401 02-04) CFSTI: $8.40

A method is discussed for embedding a chronic probe into the vascular canal of dogs for studying the hemodynamics and the effect of pharmacological agents. The discussion includes techniques of inserting the probes, major problem areas, structural materials for the probes, and preliminary results of experimentation. C.T.C.

N67-11599# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF IONIZING RADIATION ON THE CHROMOSOME APPARATUS OF HIGHER PLANTS

L. V. Nevzgodina and N. M. Grigor'yan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 371 (See N67-11401 02-04) CFSTI: $8.40

The genetic effectiveness of protons to induce plant chromosome aberrations is compared to the effectiveness of gamma radiation. In small doses differences were not detected, but in large doses protons caused a greater effect than gamma rays. Within the limits of the test doses the values of the coefficients of relative genetic effectiveness increases as the dose does from 0.7 to 2.6 for potatoes, from 1 to 3.6 for cabbage, and from 1 to 11 for carrots. A.G.O.

N67-11601# Joint Publications Research Service, Washington, D. C.

REGULATION OF HYPOXIC ERYTHROCYTOSIS

Yu. V. Nikolayenkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 374–375 (See N67-11401 02-04) CFSTI: $8.40

In a search for ways to increase the resistance of the nervous system to the action of extreme factors, experiments on the regulation of hypoxic erythrocytosis are evaluated. An assumption is made that in the absence of the chemoreceptors of the sinocarotid zones which are especially sensitive to oxygen insufficiency, information of change of the oxygen pressure in the blood comes from other interoceptors which are less sensitive to hypoxemia to the central nervous system with a delay; therefore, the starting and stopping of the implementing organs which participate in the formation of hypoxic erythrocytosis are also delayed. Thus, the sinocarotid interoceptive zone is an important link in the complex mechanism of hypoxic erythrocytosis which provides for a rapid rate of development and for cessation of this protective-adaptive reactions of the organism. Data obtained from other experiments make it possible to conclude that the cerebral cortex, in light of its particular sensitivity to oxygen insufficiency, plays a decisive role in the formation of the hypoxic erythrocytic reaction. R.U.

N67-11602# Joint Publications Research Service, Washington, D. C.

THE RELATION OF THE GASEOUS METABOLISM OF HIGHER PLANTS TO THE CONCENTRATION OF CARBON DIOXIDE IN THE AIR

N. T. Nilovskaya and M. M. Bokovaya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 376 (See N67-11401 02-04) CFSTI: $8.40

A study was made of the effect of a different content of carbon dioxide in the air on the intensity of photosynthesis and respiration of vegetable plants, as well as the method of growing: hydroponics. It was established that saturation of photosynthesis with respect to CO_2 for twelve kinds of plants is not the same and occurs at 0.15 to 0.35%. R.U.

N67-11603# Joint Publications Research Service, Washington, D. C.

THE POSSIBILITY OF USING ACTIVE SLUDGE OBTAINED IN THE PROCESS OF THE BIOLOGICAL PURIFICATION OF WASTE WATER AS A FEEDING MEANS FOR ANIMALS

R. F. Novopashina and G. S. Ratner *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 377–378 (See N67-11401 02-04) CFSTI: $8.40

The possibility of using active sludge, (obtained upon processing the residue of sedimentation tanks by prolonged blowing of air into the water) as a means of feeding animals is reported. This method is based on the high content of nitrogenous and organic matter and also the presence of certain vitamins. Effects of experiments on rams and hogs are mentioned. R.U.

N67-11604# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF STEROID HORMONES ON THE NATURE OF THE ELECTRIC ACTIVITY OF THE VEGETATIVE NERVOUS SYSTEM UNDER STRESS CONDITIONS

A. D. Nozdrachev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 379–380 (See N67-11401 02-04) CFSTI: $8.40

For space physiology purposes, the matter study of the physiological mechanisms of the adaptation of an organism to existence under extraordinations is reported. Afferent and efferent impulsation in the conductors of the sympathetic nerves, and the electrical activity of the inframesenteric sympathetic ganglion in dogs were studied under conditions of stress, and against a background of the introduction of steroid hormones. R.U.

N67-11605# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF RADIAL ACCELERATIONS ON THE CONDITIONED REFLEX ACTIVITY OF RATS

S. I. Nudman and J. K. Fedorov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 381–382 (See N67-11401 02-04) CFSTI: $8.40

For application to aviation and space flights, studies of experiments on rats are evaluated for the influence of acceleration on various physiological functions of an organism. Results of observations show that under stress conditions there is a lowering of the electrical activity of the sympathetic structure; the preliminary administration of hydrocortisone prevents the development of these changes; and, the use of desoxycorticosterone does not have a significant desoxycorticosterone R.U.

N67-11606# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE INFLUENCE OF HORMONAL PREPARATIONS ON THE RESISTANCE OF AN ORGANISM TO LOADS

V. G. Ovechkin, G. A. Nikulina, and Yu. M. Rodin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 383 (See N67-11401 02-04) CFSTI: $8.40

The biological effects of crew reaction during space flight motivated a study of the effect of various hormonal preparations on the resistance of small animals to radial accelerations. R.U.

N67-11607# Joint Publications Research Service, Washington, D. C.

A PHYCHOPHYSIOLOGICAL EVALUATION OF THE DYNAMICS AND QUALITY OF THE PERCEPTION OF AVIATION INSTRUMENTS UPON THEIR BRIEF PRESENTATION

V. G. Ovchinnikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 384–385 (See N67-11401 02-04) CFSTI: $8.40

Investigations of the dynamics of the perception of aviation instruments and numerous signal devices located in the cabin of a modern airplane were conducted. The data obtained show that upon a time exposure of 4 to 5 seconds, the pilots are able to perceive correctly the readings of seven instruments (gyrohorizon, variometer, the altitude, speed, turn, and glide indicators, radio compass, and remote gyromagnetic compass). Data for other specified exposures are also mentioned. R.U.

N67-11608# Joint Publications Research Service, Washington, D. C.

SPACE PHYSIOLOGY AS A NEW SCIENTIFIC FIELD

V. V. Parin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 386–388 (See N67-11401 02-04) CFSTI: $8.40

Space physiology, closely linked with aviation physiology, is defined as a new field. Space physiology can be divided into fields which consider the effect on the organism of certain factors in flight: vibrations, accelerations, weightlessness, isolation, etc. An important task is to study the reaction of the organism under conditions of weightlessness, prolonged isolation, and hypodynamics. R.U.

N67-11609# Joint Publications Research Service, Washington, D. C.

ESTABLISHMENT OF THE POSSIBILITY OF USING MOUNTAIN ACCLIMATIZATION FOR PREPARING AND TRAINING ASTRONAUTS

V. V. Parin, N. A. Agadzhanyan, A. G. Kuznetsov, A. S. Barer, V. A. Isabayeva et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 389–391 (See N67-11401 02-04) CFSTI: $8.40

Outlined are: (1) the conduct of complex clinical-physiological investigations during the process of mountain acclimatization; (2) the study of the influence of acclimatization in the mountains on the tolerance of the extreme factors of space flight on man; (3) the study of comparative resistance to extreme factors on the part of inhabitants of a high mountainous area, the inhabitants of a plain, and alpinist athletes; and, (4) the development of a plan of mountain acclimatization for crews of space ships and the recommendation of the use of acclimatization in the mountains to prepare and train astronauts. R.U.

N67-11610# Joint Publications Research Service, Washington, D. C.

EXPERIENCE IN USING ELECTROENCEPHALOGRAPHY IN CONNECTION WITH MEDICAL-FLIGHT EXPERT TESTIMONY

I. A. Peymer, M. L. Modin, and N. A. Govorova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 392–394 (See N67-11401 02-04) CFSTI: $8.40

To study the possibilities of the method of electroencephalography medical-flight expert testimony, electroencephalographs were made of more than 1000 pilots during their regular physical examination. It was shown that this method facilitated the detection of individual cases of latent forms of diseases (epilepsy, trauma, and tumors of the brain), among flight personnel, and also of functional disorders of the nervous system. It is therefore considered that this finding justifies wider application. R.U.

N67-11611# Joint Publications Research Service, Washington, D. C.

THE SIGNIFICANCE OF CHANGES OF THE FUNCTIONING OF THE CENTRAL NERVOUS SYSTEM, ADENOHYPOPHYSIS, AND ADRENAL CORTEX IN THE CASE OF OXYGEN STARVATION

I. R. Petrov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 395–396 (See N67-11401 02-04) CFSTI: $8.40

Results of experimental investigations were analyzed to show the sensitivity of animals to oxygen deficiency of various origins, in relation to the functional condition of the central nervous system, the adenohypophysis, and the adrenal cortex. Experiments conducted on white rats show that it is possible to artificially change the sensitivity of animals to oxygen insufficiency. To increase resistance to oxygen insufficiency, it is considered useful to concurrently use agents which cause inhibition of the central nervous system (narcotics) and agents which cause excitation of the bulbar centers. R.U.

N67-11612# Joint Publications Research Service, Washington, D. C.

A METHOD OF PSYCHOPHYSIOLOGICAL INVESTIGATION IN OPEN SPACE

Yu. A. Petrov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 397–398 (See N67-11401 02-04) CFSTI: $8.40

For application to extravehicular tasks of astronauts, methods are outlined which would permit the experimental evaluation of the dynamics in the change of certain human psychic functions under conditions of open space. Tests mentioned include those of spatial orientation, redoing tasks on geometrical figures and colors, oral correction of attention fixation on combinations of letters, and visual estimation with coordination of movements. It is pointed out that weightlessness is a necessary condition for this study method. R.U.

N67-11614# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE BIOELECTRIC ACTIVITY OF THE MYOCARDIUM IN HEALTHY AND SICK PEOPLE ACCORDING TO DATA FROM VECTOROMETRIC ANALYSIS OF AN EKG UPON BREATHING OXYGEN UNDER EXCESS PRESSURE

I. P. Poleshchuk *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 401–402 (See N67-11401 02-04) CFSTI: $8.40

Electrocardiograms (EKG) following increased intrapulmonary pressure were analyzed vectorometrically for reliability. It was found that the increased load on healthy persons causes an adequate reaction to an increase of such pressure, while persons with cardiovascular ailments show obvious changes of the bioelectric phenomena in the myocardium. Furthermore, in persons with myocardiodystrophy, there are clear signs of overloading of the atrium dextrum. R.U.

N67-11615# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE USE OF PHYSIOLOGICAL AND PSYCHOLOGICAL INVESTIGATIONS ON FLIGHT TRAINERS

N. M. Polonskiy and V. M. Strel'tsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 403–404 (See N67-11401 02-04) CFSTI: $8.40

For application to training large numbers of civil aviation pilots the advantages of the physiological and psychological methods of studying man in flight trainers are briefly mentioned. Simulated flight training data show close comparisons with data obtained during actual flight conditions. It is stated that medical-biological investigations can be conducted in a trainer to solve such problems as the physiology of labor, medical flight analysis to include professional selection, analysis and prevention of flying accidents, and the physiological hygienic evaluation and improvement of the operation positions of the aircraft crew. R.U.

N67-11616# Joint Publications Research Service, Washington, D. C.

VESTIBULAR-VEGETATIVE ADAPTATION UPON PROLONGED PERIODIC ACTION OF CORIOLIS ACCELERATIONS ON AN ORGANISM

B. I. Polyakov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 405 (See N67-11401 02-04) CFSTI: $8.40

To investigate the possibility of creating artificial gravity by rotating a space ship about its own axis, studies were made on the vestibular apparatus of rabbits subjected to prolonged rotation. The change in threshold, and the times of the onset and nature of the vestibular-vegetative adaptation, depending on the duration of the effect, were established. The Coriolis accelerations, motion sickness, and nystagmic reactions are mentioned. R.U.

N67-11617# Joint Publications Research Service, Washington, D. C.

THE DYNAMICS OF THE BLOOD PRESSURE IN THE RIGHT VENTRICLE OF THE HEART UPON AN INCREASE IN INTRAPULMONARY PRESSURE

V. L. Popkov and I. N. Chernyakov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 406 (See N67-11401 02-04) CFSTI: $8.40

The theory of hyperfunctioning of the right ventricle following an increase of intrapulmonary pressure was assessed by heart soundings conducted on dogs. The dynamics of the blood pressure were ascertained by analyzing the systolic and diastolic pressure recorded. It was concluded that a lag of pressure in the right ventricle of the heart from the increase of intrapulmonary pressure, repudiates the old concept that an increase of the pressure in the right ventricle of the heart, under these conditions, is connected with a mechanical transfer of heart pressure from the expanding lungs. R.U.

N67-11619# Joint Publications Research Service, Washington, D. C.

EVALUATION OF THE PHENOMENON OF ZERO MINIMUM ARTERIAL PRESSURE ACCORDING TO KOROTKOV IN ASTRONAUT FLIERS

Ye. A. Poruchikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 409–410 (See N67-11401 02-04) CFSTI: $8.40

Studies of the occurrence of zero minimum arterial pressure in astronauts are briefly mentioned in connection with the phenomenon of infinite tone. It is pointed out that conclusions reviewed are not only contradictory but are, at times, in direct opposition. The occurrence of infinite tone after laboratory loads and sports loads is noted. It is pointed out that the use of the method of analyzing the peculiarities of the sound of an artery in the case of the phenomenon of infinite tone for functional evaluation of the cardiovascular system in astronauts provides diagnostic assistance for doctors. R.U.

N67-11620# Joint Publications Research Service, Washington, D. C.

A CALCULATED ESTIMATE OF THE STRENGTH OF THE SPINE OF A MAN UNDER A LONGITUDINAL BLOW WITH THE LOAD INCREASING AT GREAT SPEED (COMPARISON WITH AN EXPERIMENT)

B. A. Rabinovich *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 411–412 (See N67-11401 02-04) CFSTI: $8.40

Experimental analysis are briefly reviewed of human physiological capabilities to withstand shock during spacecraft landings. It is reported that the sagging of the human body under a shock action is significantly reduced as the speed of the increase of the load becomes larger. Pain sensations experienced in the spine during landing are mentioned. R.U.

N67-11621# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE INFLUENCE OF ADEQUATE VESTIBULAR STIMULI ON THE FUNCTIONING OF EXTERNAL RESPIRATION IN MAN

L. A. Radkevich *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 413–414 (See N67-11401 02-04) CFSTI: $8.40

Consideration is given to the phase duration of inspiration and expiration, the ratio of inspiration phase duration to the duration of the expiration phase, and the frequency of respiratory movements per minute. It is reported that the tests which characterize the functioning of external respiration can serve as a specific criterion of resistance to vestibular stimuli. A.G.O.

N67-11622# Joint Publications Research Service, Washington, D. C.

RESULTS OF AN EXPERIMENTAL INVESTIGATION OF AIR SICKNESS

N. A. Razsolov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 415–416 (See N67-11401 02-04) CFSTI: $8.40

Modelling of motion sickness according to the method of double rotation under ordinary conditions and in a barometric chamber was used as a special functional diagnosis technique for determining partial insufficiency of individual organism physiological systems. Experimental results from modelling studies are discussed, and suggestions for prevention and treatment of air sickness are briefly covered. A.G.O.

N67-11623# Joint Publications Research Service, Washington, D. C.

FUNCTIONAL-HISTOLOGICAL CHANGES IN THE LIVER UNDER ACCELERATIONS

M. I. Razumov and I. M. Khazen *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 417–418 (See N67-11401 02-04) CFSTI: $8.40

The investigations on dogs subjected to chest–back directed accelerations of an 8 g magnitude for three minutes are reported. The general reaction in the liver was determined to be moderate fat infiltration of cells of the epithelium from the second to the thirtieth day after acceleration. In the nuclei of many cells, brilliant crystals of a prismatic form which strongly refracted light were noted. Damage to the intracellular structures of the epithelium involved displacement of the nuclei in the cytoplasm and disturbance in the chromatin of the nuclear matter. This disruption in protein synthesis is considered to cause the formation of the large prismatic crystals. N.E.N.

N67-11624# Joint Publications Research Service, Washington, D. C.

HIGHER HETEROTROPHS (BIRDS) AS A SOURCE OF FOOD IN SPACE

G. S. Ratner *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 419 (See N67-11401 02-04) CFSTI: $8.40

The possible use of chickens and ducks in feeding systems for extended space flights is reviewed. It is suggested that poultry would provide rich food products and economical use could be made of the residues and wastes which are formed. N.E.N.

N67-11625# Joint Publications Research Service, Washington, D. C.
THE QUESTION OF THE USE OF CERTAIN KINDS OF HIGHER AND LOWER HETEROTROPHS IN A SYSTEM OF LIFE SUPPORT FOR SMALL CLOSED AREAS
G. S. Ratner, N. M. Tikhonravova, A. N. Atamanenko, R. F. Novopashina, and A. M. Pakhorukov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 420–421 (See N67-11401 02-04) CFSTI: $8.40

A series of heterotrophic organisms which may be promising for use in life support systems to supply astronauts with products of animal origin is surveyed. Plant-eating and omnivorous fish, and water invertebrates are mentioned. The inclusion of primary utilizers of organic matter for animal food and for the utilization of waste products is recommended. N.E.N.

N67-11626# Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF PREDNISOLONE ON THE RESISTANCE OF THE NEURO-MUSCULAR APPARATUS TO THE EFFECTS OF REPEATED ADMINISTRATIONS OF ADRENALIN
A. M. Rafikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 422–423 (See N67-11401 02-04) CFSTI: $8.40

The electric potentials of the musculus gastrocnemius of narcoticized cats were recorded under the influence of an electronic stimulus alone, with adrenalin, and with adrenalin administered after prednisolone. It was found that adrenalin administered after prednisolone did not suppress the electrical potentials. N.E.N.

N67-11627# Joint Publications Research Service, Washington, D. C.
THE QUESTION OF THE PHYSIOLOGICAL MECHANISMS OF WRITTEN SPEECH
N. M. Rachkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 424–426 (See N67-11401 02-04) CFSTI: $8.40

The dynamics of writing spoken words were studied using an electric pencil. The magnitude of the latent period of the response reaction, the magnitude of the pressure on the point of a pencil, the time for writing a word and a phrase, the nature of the pressure curve, the quantity of breaks of pencil from paper, and the intervals between words were recorded. It was found that the pressure is greatest at the end of the the word when the spoken word is familiar. On the other hand, the pressure is greatest at the beginning or the middle when the word is unfamiliar or when writing the first word which comes to mind which begins with the last letter of the previous word. Physiological explanations are suggested. N.E.N.

N67-11628# Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF PARTIAL RESTRICTION OF MOTOR ACTIVITY ON THE HIGHER NERVOUS ACTIVITY OF APES
Ye. S. Rogovenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 427–428 (See N67-11401 02-04) CFSTI: $8.40

The effects of restriction on the ability of monkeys to solve problems connected with distinguishing the probability of some event, with grasping a certain sequence of these events, and with developing certain rules of behavior were studied. Four restricted and four free monkeys (Macaca, Capuchin, and Pavian-Hamadril) were tested, using three programs. The procedures are described, and it was shown that the monkeys are able to evaluate their own actions with respect to the probability of their reinforcement. However, they did not establish connections between separate actions. It was further concluded that complex behavioral reactions in the restricted monkeys did not differ from those in the control group. N.E.N.

N67-11629# Joint Publications Research Service, Washington, D. C.
MOTION AND LIFE
D. Ya. Rosenblyum *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 429 (See N67-11401 02-04) CFSTI: $8.40

Abstracted data are summarized on the movements at the molecular, subcellular, cellular, and systemic levels. The evolution of movements at the organism level with control mechanisms, and data from fresh water fish in a turbulent water flow are mentioned. N.E.N.

N67-11630# Joint Publications Research Service, Washington, D. C.
THE RELATIVE BIOLOGICAL EFFECTIVENESS OF PROTONS OF 126 MeV UPON REPEATED IRRADIATIONS WHICH HAVE BEEN LIKENED IN FREQUENCY TO SOLAR FLARES
N. I. Ryzhov, N. N. Derbeneva, V. M. Seraya, T. Ye. Mashinskaya, D. Ya. Aparina et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 430–431 (See N67-11401 02-04) CFSTI: $8.40

Two groups of Vistar rats were irradiated, one group with 126 MeV protons and the other with 180 kilovolt X-ray doses in one-time doses of 25, 50, 100, 200, and 400 rad. During the year, the animals were subjected to 9-time action in total doses respectively of 225, 450, 900, 1800, and 3600 rad. The results showed that with repeated irradiation there developed a reaction, the severity of which depended on the single and total doses. The individual differences in reaction to proton and X-ray irradiation are outlined, and it was concluded that the general biological effectiveness of repeated proton irradiation does not differ qualitatively or quantitatively from X-ray radiation. N.E.N.

N67-11631# Joint Publications Research Service, Washington, D. C.
PHYSIOLOGICAL ANALYSIS OF CHANGES OF ELECTRO-ETINOGRAMS AND PRIMARY RESPONSES OF VARIOUS PARTS OF THE VISUAL ANALYZER UNDER CERTAIN EXTREME INFLUENCES (ACCELERATION, DROP OF PRESSURE, HYPOXIA)
B. M. Savin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 432–433 (See N67-11401 02-04) CFSTI: $8.40

During chronic tests on non-narcoticized cats, recordings were made of electroretinograms and the primary responses of the corpi geniculatum laterale, the upper tubercles of the lamina quadrigemina, and the visual cortex. The experiment included loading in the head–pelvis direction, decompression and compression pressure changes, and hypoxia upon ascent and altitude simulation in a barometric chamber. It was established that the electroretinogram and primary responses are different, and the results are summarized. N.E.N.

N67-11632# Joint Publications Research Service, Washington, D. C.
THE INFLUENCE OF THE SPATIAL DISTRIBUTION OF AN ABSORBED DOSE ON THE COURSE OF RADIATION INJURY TO DOGS
N. Ya. Savchenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 434 (See N67-11401 02-04) CFSTI: $8.40

A study of biological action of radiation with a large drop in the absorbed doses with depth is reported. Uneven spatial distribution was achieved by multi-sided irradiation with soft and hard X-rays. N.E.N.

N67-11633# Joint Publications Research Service, Washington, D. C.

PROBLEMS OF THE PHARMACOCHEMICAL PROTECTION OF AN ORGANISM FROM IONIZING RADIATION ON SPACE FLIGHTS

P. P. Saksonov, V. V. Antipov, N. N. Dobrov, V. A. Kozlov, and V. S. Shashkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 435–436 (See N67-11401 02-04) CFSTI: $8.40

The present state-of-the-art of increasing the radiation resistance of organisms using pharmacochemical agents is briefly summarized. The radiation effects are mentioned, and the directions which future investigations should take are outlined. N.E.N.

N67-11634# Joint Publications Research Service, Washington, D. C.

ASPECTS OF NERVE-REFLEX REGULATION OF RESPIRATION UNDER CONDITIONS OF INTRAPULMONARY PRESSURE

V. A. Safonov *In its* Probl. in Aerospace Med. 21 . ,t. 1966 p 437–438 (See N67-11401 02-04) CFSTI: $8.40

Studies on the changes in afferentation under respiration with excess intrapulmonary pressure and also on the character of the excitation of the respiratory center are briefly reported. The electrical activities of the vagus and phrenic nerves, the musculus rectus abdominis, and the inner musculus intercostalis were recorded. A profound readjustment in the functioning of the cellular components of the respiratory center of the medulla oblongata was found. N.E.N.

N67-11635# Joint Publications Research Service, Washington, D. C.

THE USE OF CERTAIN CONCEPTS OF THE FACTOR STRUCTURE OF AN EXPERIMENT FOR ANALYSIS OF CHANGES OF THE LATENT PERIOD OF CONDITIONED REFLEX REACTIONS OF MAN UNDER THE INFLUENCE OF PHYSIOLOGICAL STIMULI

I. V. Sviatunov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 439–440 (See N67-11401 02-04) CFSTI: $8.40

The influence of differently applied stimuli on the duration of the latent period of the conditioned motor reactions was studied. The following factors were considered: number of different applied stimuli, sequence number of experiment, duration of the interval between stimulation, and the probability of the applied stimuli. No statistically reliable interrelation of the factors was determined. N.E.N.

N67-11636# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF CHANGES OF GRAVITATION ON THE VASCULAR REFLEXES FROM THE SINOCAROTID REGION

Yu. A. Senkevich, V. A. Lashchenova, and I. N. Kotova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 441 (See N67-11401 02-04) CFSTI: $8.40

Investigations were made of dogs' reflexes upon the application of pressure to the common carotid artery, distention of the sinuses of the electrostimulation of the Hering nerve, and also the administration of cytitone and a hypertonic solution of sodium chloride. Tests were conducted on an inclined table and under the influence of transverse loads of up to 9 g, and the effect of loads was found to decrease and distort the indicated reflexes. N.E.N.

N67-11637# Joint Publications Research Service, Washington, D. C.

CHANGES IN THE HEMATOPOIETIC SYSTEMS OF RATS IRRADIATED WITH PROTONS WITH AN ENERGY OF 126 MeV AND GAMMA RAYS OF COBALT-60

V. M. Seraya, N. I. Ryzhov, N. N. Daryaneva, T. Ye. Mashinskaya, D. Ya. Oparina et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 442–443 (See N67-11401 02-04) CFSTI: $8.40

Hematological changes caused by proton irradiation from a synchrocyclotron and by Co^{60} gamma radiation were compared. A phase character was noted in the changes in quantity of leucocytes and the nucleus-bearing cells in bone marrow. Details are given on these phases. It was found that the processes of the disturbance of hematopoiesis are identical but that the degree of their manifestation and the times of their occurrence are somewhat different. N.E.N.

N67-11638# Joint Publications Research Service, Washington, D. C.

PSYCHOPHYSIOLOGICAL ASPECTS OF THE ACTIVITY OF A PILOT DURING INSTRUMENT FLYING AFTER A BREAK IN FLYING LASTING 1.5 TO 2 MONTHS

V. A. Sergeyev, D. V. Abayev, L. P. Vokhmyanin, V. V. Davydov, I. G. Diusskaya et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 444 (See N67-11401 02-04) CFSTI: $8.40

Investigations conducted on a specially equipped fighter aircraft using a complex of physiological–clinical and psychological methods is reported. It was found that the quality of the techniques was retained in most pilots, but the timing and accuracy of the correcting reactions changed. N.E.N.

N67-11639# Joint Publications Research Service, Washington, D. C.

THE SENSITIVITY OF THE RECEPTORS OF THE LUNGS WHICH HAVE BEEN INNERVATED BY BEING DEMYELINIZED WITH FIBERS AGAINST CHANGES IN THE GASEOUS COMPOSITION OF INHALED AIR

Z. N. Sergeyeva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 445 (See N67-11401 02-04) CFSTI: $8.40

Results of tests conducted on cats with an open chest cage employing chloralose urethane narcosis and artificial respiration are briefly described. It was found that lung receptors innervated with unmyelinized fibers possess a constant tonic activity, and that the activity does not change when the animals breathe a mixture containing 5–12% CO_2 or nitrogen. It was concluded that pulmonary receptors innervated with unmyelinized fibers are not chemoreceptors. N.E.N.

N67-11640# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF ESTABLISHING THE RELATIONSHIP BETWEEN SPEED OF DECOMPRESSION AND THE ALTITUDE RESISTANCE OF AN ORGANISM

A. V. Sergiyenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 446–447 (See N67-11401 02-04) CFSTI: $8.40

The relation between altitude resistance in rats and the speed of decompression was observed in a barometric chamber. It was found that the slower the rate of ascent, the lower the altitude ceiling was, and vice versa. No clear relation was determined between the cardiac activity and the rate of ascent, however the period of restoration occurred more slowly with the slower rate of ascent. The rectal temperature reduced more with slow ascents, and practically not at all with quick ascents. Intense spasms were also noted in during fast rates of ascents, and only slightly with slow rates. It was concluded that the optimum decompression speed is 2 m/sec, at which rate the compensatory mechanisms were developed most fully. N.E.N.

N67-11642# Joint Publications Research Service, Washington, D. C.

RESTORATION OF VITALLY IMPORTANT FUNCTIONS OF AN ORGANISM UPON CLINICAL DEATH CAUSED BY ACUTE ANOXIA AND RADIAL ACCELERATION

N. N. Sirotinin, V. D. Yankovskiy, N. P. Adamenko, Yu. F. Gerya, and A. P. Morozov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 450–451 (See N67-11401 02-04) CFSTI: $8.40

Reanimation experiments of organisms following clinical death are recapitulated. Time lapses in restoration of vital functions are briefly enumerated for death following respiratory failure, electric shock and asphyxiation of the newborn. Reanimation of dogs after clinical death from radial acceleration and acute anoxia is also mentioned. R.Li.

N67-11643# Joint Publications Research Service, Washington, D. C.

THE INTERACTION OF A SERIES OF INDICES OF THE OXYGEN REGIME OF AN ORGANISM UNDER THE INFLUENCE OF REDUCED BAROMETRIC PRESSURE AND LONG-ACTING ACCELERATIONS

Ye. I. Sorokina *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 452–453 (See N67-11401 02-04) CFSTI: $8.40

The dynamics of the regulation of oxygen in an organism are reviewed for the following cases: hypoxic hypoxia for varying barometric pressures, and a mixed form of hypoxia with the presence of a hemodynamic factor under the influence of transverse accelerations. Experiments on white rats, and determinations of oxygen pressure and the oxidizing- reducing potential in muscular and brain tissues are also mentioned. R.Li.

N67-11644# Joint Publications Research Service, Washington, D. C.

A DEFICIT OF EXCITATION AND STIMULATION

G. N. Sorokhtin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 454–455 (See N67-11401 02-04) CFSTI: $8.40

For application to theoretical and practical neurology and space physiology, the physiological reaction of systems to an insufficiency of excitation and stimulation are reviewed. Outlined briefly are studies on: spinal shock syndrome of a deficit of excitation; passive hyperpolarization development in the skeletal muscle, salivary gland, and sympathetic ganglion; central inhibition blockage interrupting impulse excitation; strychninization leading to active depolarization; natural, hypnotic, and barbiturate sleep accompanied by hyperpolarization of the cerebral cortex. R.Li.

N67-11645# Joint Publications Research Service, Washington, D. C.

THE MECHANISM OF THE ACTION OF DEEP HYPOTHERMIA ON THE FUNCTIONING OF THE BRAIN

P. M. Starkov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 456–457 (See N67-11401 02-04) CFSTI: $8.40

The effects of cold and hypoxia on brain function are reviewed. Conclusions are briefly outlined on: the processes of exclusion of conditioned reflexes, of a convulsive reaction, of the direct excitability of the cortical cells, of the electroencephalograms (EEG) caused by potentials and strychnine excitation. Hypothermia experiments down to 3 degrees and lower are mentioned. R.Li.

N67-11646# Joint Publications Research Service, Washington, D. C.

SOME QUESTIONS OF THE MECHANISM OF THE ACTION OF NOISE ON AN ORGANISM

A. B. Strakhov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 458–459 (See N67-11401 02-04) CFSTI: $8.40

Reaction to noise stimuli, in particular on the central nervous and cardiovascular systems, is surveyed. Generalized changes recorded on human and animal electroencephalograms, accompanying changes in respiratory function, in the cardiovascular system, and in the subcortical brain structure are mentioned. The administration of scopolamine preparations to prevent the development of suppressed responses to the influence of noise is also reviewed. R.Li.

N67-11648# Joint Publications Research Service, Washington, D. C.

REDUCTION OF THE EFFECTIVENESS OF CHEMICAL PROTECTION WITH SMALLER DOSES OF RADIATION

V. I. Suslikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 462–463 (See N67-11401 02-04) CFSTI: $8.40

For the radiation safety of man during space flights, experiments with chemical protective agents were conducted. The toxicity pattern of chemical agents for nonirradiated animals, and the increased sensitivity of irradiated specimens to the toxic action of these agents are mentioned. It is stated that the existing view on the non-toxicity of cystaphos is incorrect, according to experiments reported. R.Li.

N67-11650# Joint Publications Research Service, Washington, D. C.

THE GAMMA-AMINOBUTYRIC ACID SYSTEM IN THE BRAIN OF ANIMALS UNDER THE INFLUENCE OF LOADS

I. A. Sytinskiy and Ye. L. Avenirova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 466 (See N67-11401 02-04) CFSTI: $8.40

The gamma-aminobutyric acid system, which has an inhibiting effect on the bioelectric processes in the cerebral cortex, is studied to determine the effect of accelerations. Under the influence of loads the system of gamma-aminobutyric acid in the brain did not change. The hemato-encephalic barrier effectively blocked the penetration of the acid into the brain when administered. However, the effect of loads was manifested in a disturbance of the integrity of the hemato-encephalic barrier with the occurrence of a depressive action in the central nervous system due to the penetration of the gamma-aminobutyric acid. S.P.

N67-11651# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF COMPLEX PREPARATIONS IN PREVENTING MOTION SICKNESS ON REFLEX ACTIVITY

P. I. Syabro *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 467–468 (See N67-11401 02-04) CFSTI: $8.40

Preparations of platybrin, plavephyn, and phaplavine were administered to dogs to test their effectiveness in preventing motion sickness during flight. The complex preparations did not cause a lowering of the reflex activity or a change in the content of acetycholine, catecholamines, and cholinesterase of the blood. S.P.

N67-11652# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF HUMAN TOLERANCE OF BRIEF GYRATIONS WITH LARGE MAGNITUDES OF ANGULAR ACCELERATIONS AND SPEEDS

V. M. Tardov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 469–470 (See N67-11401 02-04) CFSTI: $8.40

Human resistance to the effect of brief angular accelerations (0.2 and 0.25 seconds) was demonstrated in a series of rotation tests. Rotation was accomplished around a transverse axis passing near the center of gravity of the test subject, and also around a longitudinal axis of the body passing vertically between the pyramids of the temporal bones; in both series of experiments there was an absence of vestibular disorders and nystagmus. It was concluded that brief specific action on the semicircular canal of the labyrinth, even in the case of considerable angular accelerations, is a weak stimulus for the vestibular analyzer. S.P.

N67-11653# Joint Publications Research Service, Washington, D. C.

NEW METHODS FOR STUDYING THE INTERACTION BETWEEN THE VISUAL AND VESTIBULAR ANALYZERS

Ye. T. Ter-Gazaryabts *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 471–472 (See N67-11401 02-04) CFSTI: $8.40

Methods for investigating the reactivity of stimulated visual and vestibular analyzers are presented. One method consists of recording the electroretinogram and the electrocardiogram of animals, not under narcosis, located in a screened chamber on special swings which perform attenuating oscillations. A second method is directed toward examination of the peripheral part of the visual apparatus of insects under centrifuging. S.P.

N67-11654# Joint Publications Research Service, Washington, D. C.

FUNDAMENTAL PROBLEMS OF THE MINIMIZATION OF VITAL ACTIVITY

N. N. Timofeyev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 473 (See N67-11401 02-04) CFSTI: $8.40

The study of physiological patterns in animals with phylogenetic development of different complexity was advocated in the interest of space biology and medicine. It was shown experimentally that a lowered vital activity considerably increased the resistance of an organism to various simultaneously acting extreme factors not compatible with a normal life. G.G.

N67-11655# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF BREATHING OXYGEN UNDER EXCESS INTRAPULMONARY PRESSURE ON THE ELASTIC PROPERTIES OF THE LUNGS

M. A. Tikhonov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 474–475 (See N67-11401 02-04) CFSTI: $8.40

Elastic lung properties of 38 dogs under morphine-urethane narcosis were investigated by observing the influence of increased intrapulmonary pressure without the use of external compensation and also with compensating clothing. Tensility as measured immediately after cessation of respiration under excess pressure without external compensation increased in all animals by an average of 60% and returned close to the control level after about 2 to 2.5 hours. In tests employing external compensation, lung tensility increased only by 17% and returned to the initial level within 15 to 30 minutes. It was concluded that the above observed lung tensility increase was mainly a manifestation of hysteresis due to a change of volume in the lungs, the quantity of the functioning alveoli, and the strength of the surface tension in the alveoli. G.G.

N67-11656# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF HELIUM ON THE CONDITIONED REFLEX ACTIVITY AND GASEOUS METABOLISM OF ANIMALS

G. V. Troshikhin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 476–477 (See N67-11401 02-04) CFSTI: $8.40

Observed was the development speed of defensive conditioned reflexes and the dynamics of gaseous exchange in male white mice exposed for one month to an atmosphere containing 21% oxygen and 79% helium at various environmental temperatures. Experiments showed that mice exposed to the gaseous mixture at 21 to 23°C had a slower development of their conditioned reflexes; in a similar atmosphere but with temperatures increased by 3 to 4°C, the conditioned reflexes of the mice formed at almost the same time as those in controls animals kept in a normal atmosphere. No differences were detected in the level of oxygen consumption, although the rectal temperatures of mice kept in the helium-oxygen atmosphere was slightly lower than those of the control group. G.G.

N67-11658# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF FEEDING ON SPACE FLIGHTS

A. S. Ushakov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 480–481 (See N67-11401 02-04) CFSTI: $8.40

Dehydrated food products in combination with regenerated water were considered for their quantitative and qualitative adequacy in human diets during space flights. At the present time, a closed biological system employing unicellular algae, higher plants, and food animals seems to hold the best promise of providing proper spacecrew nutrition. Physical-chemical synthesis of carbohydrates from the products of vital activity along with the creation of amino acids, fatty acids, mineral compounds, and vitamins on board of the space ship also seems feasible. G.G.

N67-11660# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE ELASTIC-COHESIVE PROPERTIES OF THE MUSCLES OF MAN UNDER THE INFLUENCE OF HYPOKINESIA

V. L. Fedorov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 484–485 (See N67-11401 02-04) CFSTI: $8.40

Seismotonographic and tonometric recordings on mechanical fluctuations of the musculus rectur femoris, the musculus biceps brachii, and the extensor muscles of the lumbar part of the spinal column of man were reported. Results of strictly dosed blows were judged according fluctuation; (1) the frequency of muscle fluxtuation; (2) the logarithmic dampening decrement of the muscle fluctuations; and (3) the tonometer readings. It was concluded that functional properties of all muscles changed under the influence of many days of hypokinesis; the increase of cohesiveness and the lowered elasticity of the skeletal muscles was pronounced. G.G.

N67-11661# Joint Publications Research Service, Washington, D. C.

THE POSSIBILITY OF THE ADAPTATION OF AN ORGANISM TO EXTREME EFFECTS OF THE EXTERNAL ENVIRONMENT

L. A. Fel'dman *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 486–487 (See N67-11401 02-04) CFSTI: $8.40

Examinations of pilots in routine flights on a familiar airplane while performing monotonous flight assignments are reported. A 40%–50% increase in pulse rate was found in simple uncomplicated flight, and greater pulse rates with increasingly complicated flight assignments. The frequency of pulse was noted to be the highest as the culminating moment of the assignment drew near. N.E.N.

N67-11662# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE SPEED OF A RESPONSE REACTION AFTER THE ACTION OF SHOCK LOADS

N. I. Frolov and G. P. Mirolyubov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 488–489 (See N67-11401 02-04) CFSTI: $8.40

A physiological evaluation of human tolerance to shock loads of various magnitudes is reported. The latent period of simple motor reactions to light stimuli was studied. It was determined that: (1) In repeated tests with shock loads there is a relative adaptation which is manifested by a decrease of the shifts of the latent period. (2) The quality of the reaction changes. (3) There is a shortening of the latent period with small magnitude loads, and a lengthening of the period with large magnitude loads. N.E.N.

N67-11663# Joint Publications Research Service, Washington, D. C.

NEW DATA ON THE INFLUENCE OF ACCELERATIONS ON THE SECRETORY AND MOTOR FUNCTIONING OF THE DIGESTIVE SYSTEM

I. M. Khazen *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 490–491 (See N67-11401 02-04) CFSTI: $8.40

The influence of accelerations of various magnitude, direction, and duration on dogs is reviewed. Regular changes of the functioning of the salivary, gastric, pancreatic, and intestinal glands were noted. Shifts in the phasic nature in the secretion of pancreatic juice and the formation of enzymes, and pathomorphological and histochemical disturbances of tissue structures are mentioned. The results showed the importance of the neuroglandular apparatus of the digestive system as an indicator of the reaction of the organism to accelerations. N.E.N.

N67-11665# Joint Publications Research Service, Washington, D. C.

THE BIOLOGICAL EFFECT OF MAGNETIC FIELDS

Yu. A. Kholodov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 493–494 (See N67-11401 02-04) CFSTI: $8.40

The effects on biological organisms of increased or decreased magnetic fields are briefly reviewed. It is pointed out that the effects have been established at the molecular, cellular, and systemic levels, and also on the whole organism. N.E.N.

N67-11666# Joint Publications Research Service, Washington, D. C.

THE EFFECTIVENESS OF USING EXTERNAL COMPENSATION IN THE CASE OF EXPLOSIVE DECOMPRESSION

A. S. Tsivilashvili and A. Ye. Ivanov *In its* Probl. of Aerospace Med. 21 Oct. 1966 p 495–496 (See N67-11401 02-04) CFSTI: $8.40

Protecting humans and animals from pathological changes caused by explosive decompression was investigated. It was found that it was safe for humans to have changes of barometric pressure of 220–285 mm of mercury in 0.5–0.8 seconds when wearing an altitude-compensating suit and oxygen apparatus to create excess pressure in the lungs. No pathological changes in man were noted after prolonged period of time or after repeated pressure changes, and no changes were detected in animals. N.E.N.

N67-11667# Joint Publications Research Service, Washington, D. C.

DYNAMIC MEDICAL CONTROL OF FLIGHT PERSONNEL UNDER CONDITIONS OF FLYING ACTIVITY

A. V. Chapek and V. P. Yerokhin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 497–498 (See N67-11401 02-04) CFSTI: $8.40

Physiological research in flight trainers and in aircraft under flight conditions is briefly reviewed. Electrocardiograms and recordings of arterial pressure, frequency of respiratory movements, and body temperature are mentioned. Reference is made to results of tests on subjects with partially inadequate health. N.E.N.

N67-11668# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF IMPULSE NOISE CREATED BY MODERN AIRPLANES ON THE HUMAN ORGANISM

A. V. Chapek, B. M. Mirzoyev, and V. N. Somonov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 499–500 (See N67-11401 02-04) CFSTI: $8.40

Physiological responses in humans to sonic booms at a point directly beneath the flight trajectory were investigated. With a boom intensity of 8.4 kg/m^2, a slight quickening of the pulse and a lowering of the alpha rhythm of the EEG were noticed. The biopotentials of the heart, acuteness of hearing, visual image duration and latent periods, and corticosteroids of the blood did not change significantly. With an intensity of up to 7.5 kg/m^2 no shifts of physiological functions were detected. N.E.N.

N67-11669# Joint Publications Research Service, Washington, D. C.

A DEVICE FOR STUDYING INTERDEPENDENT GROUP ACTIVITY (FROM 2 TO 8 OPERATORS)

L. S. Chesalin, N. Ye. Dmitriyev, F. D. Gorbov, M. A. Novikov, and V. I. Ushakov *In its* Probl. of Aerospace Med. 21 Oct. 1966 p 501–502 (See N67- 11401 02-04) CFSTI: $8.40

The portable instrument is described which consists of 8 small identical panels, indicating devices, and potentiometers. It is possible to create commands and to divide the group into unrelated subgroups. Formulas are presented establishing the instrumental readings at an individual panel and for the whole instrument. N.E.N.

N67-11670# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF RADIAL ACCELERATIONS ON THE IMMUNOLOGICAL REACTIVITY OF AN ORGANISM

V. M. Shilov, N. N. Dobronravova, and M. I. Kozar *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 502–504 (See N67-11401 02-04) CFSTI: $8.40

Experiments to determine the effect of transversely directed radial accelerations on physiological systems of rats are briefly described. It was found that under 20, 25, and 30 g's the rats displayed brief shifts of immunological reactivity. N.E.N.

N67-11671# Joint Publications Research Service, Washington, D. C.

THE MECHANISMS OF INJURY AND DEFENSE OF THE BONE MARROW OF ANIMALS IN THE CASE OF PROTON AND X-RAY RADIATION

N. L. Shmakova and S. P. Yarmonenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 505–506 (See N67-11401 02-04) CFSTI: $8.40

Experimental data on radiation effects on the bone marrow of mice are reviewed. Cytologic analysis showed that the leading component of radiation damage during the first day is the delay of cellular division and the discharge of regular elements into the bloodstream. It was found that chromosome damage of the cells do not affect the rate of bone marrow exhaustion, but do determine the outcome of radiation injury. N.E.N.

N67-11672# Joint Publications Research Service, Washington, D. C.

THE REACTION OF THE ERYTHROPOIESIS OF ANIMALS TO INCREASED PARTIAL PRESSURE OF OXYGEN IN THE ENVIRONMENT

A. M. Shmeleva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 507–508 (See N67-11401 02-04) CFSTI: $8.40

The dynamics of oxygen on the erythropoietic functioning was studied, using the acid resistance of the erythrocytes of white mice and rats. Exposures of 15 days, 36 hours, and 90 minutes with different oxygen content are reported. It was concluded that the effect of an environment with an increased partial pressure of oxygen is not always the same, but depends also on the intensity and duration of the hyperoxic effect. N.E.N.

N67-11673# Joint Publications Research Service, Washington, D. C.

THE INTERRELATION BETWEEN THE CENTER AND THE PERIPHERY OF THE RETINA UPON THE ACTION OF BRIEF INTENSIVE LIGHT FLASHES AGAINST A BACKGROUND OF FULL ADAPTATION TO DARKNESS

V. I. Shostak *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 509–510 (See N67-11401 02-04) CFSTI: $8.40

The restoration of light sensitivity was investigated. After 30-minute darkness adaptation a flash was given while screening

10° of the center of the retina, and after restoration of light sensitivity a second flash was given without screening. It was found that light sensitivity was restored more quickly with screening. It was concluded that the central part of the retina has an inhibiting effect on the adaptation to light of the periphery. N.E.N.

N67-11674# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF AMINAZINE ON THE RESISTANCE OF AN ORGANISM TO HIGH AND LOW TEMPERATURES

I. P. Shcherbachev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 511 (See N67-11401 02-04) CFSTI: $8.40

Mice were given 5 mg/kg of aminazine to determine if aminazine can be used to increase resistance to temperature. It was found that resistance to low temperatures was decreased and resistance to high temperatures was increased. N.E.N.

N67-11675# Joint Publications Research Service, Washington, D. C.

THE VESTIBULAR APPARATUS AS THE ORGAN OF THE NON-SPECIFIC ADAPTATION OF AN ORGANISM

Ya. A. Egolinskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 512–514 (See N67-11401 02-04) CFSTI: $8.40

Consideration is given to the vestibular apparatus effects in the adaptive reactions of the organism, including the adaptation to muscular activity and to the action of various stressors. Results are discussed from experiments conducted to determine systematic training influences on the resistance of an organism under a series of unfavorable conditions. Based on the data obtained, it is postulated that systematic action on the vestibular apparatus has a general toning effect on the organism. A.G.O.

N67-11676# Joint Publications Research Service, Washington, D. C.

THE SIGNIFICANCE OF CERTAIN FORMATIONS OF THE CENTRAL NERVOUS SYSTEM IN THE DEVELOPMENT OF AN OXYGEN INSUFFICIENCY AND ADAPTATION TO IT

N. Z. Epshteyn *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 515–516 (See N67-11401 02-04) CFSTI: $8.40

A study was conducted to determine the role of the hypothalamus in the mechanisms of development and compensation for oxygen deficiency. Experiments were performed on various parts of the hypothalamus to study the adaptation of an organism to an insufficiency of oxygen and its reaction to acute hypoxia. From an analysis of experimental data it is assumed that the breakdown of the anterior hypothalamus is accompanied by significant changes of the metabolic processes in the organism which affect the general reactivity of the organism, and especially, its resistance to an oxygen deficiency. A.G.O.

N67-11677# Joint Publications Research Service, Washington, D. C.

MATERIAL ON THE PHYSIOLOGICAL-HYGIENIC BASIS OF THE ALLOWABLE LEVELS OF IMPULSE NOISES (SOUND SHOCKS)

Ye. M. Yuganov, B. M. Mirzoyev, Yu. V. Krylov, and V. S. Kuznetsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 517–518 (See N67-11401 02-04) CFSTI: $8.40

Sound shock effects on the physiological functioning of an organism were studied. Consideration was given to the effect of single sounds on the human organism, and the cumulative effect of sound shock over the course of 5 days. In experiments with cumulative sound shock action of an intensity of 7-7.5 kg/m^2 changes were noted in the indices of mental working ability, in the EEG and EKG, and in the functioning of the auditory, vestibular, and motor analyzers. A.G.O.

N67-11694*# West Virginia Univ., Morgantown. Biomechanics Lab.

ELECTRIC FIELDS AND CALCIUM MOBILITY IN BONE
Final Report

James Mc Elhaney, Richard Stalnaker, and Robert Bullard 21 Sep. 1966 81 p refs
(Grant NsG-533)
(NASA-CR-79539) CFSTI: HC $3.00/MF $0.75 CSCL 06S

Investigations of the effect of electric fields on calcium mobility of the bone are reported. Each of 48 100-gram male rats had electric plates and a plaster of Paris cast placed on his right leg. A comparison was made between the right and left femurs of the treated rats to determine the per cent difference in measured parameters of weight, specific gravity, cross-sectional area, compression properties, hardness, osteone count, and chemical properties. Seventy-three percent of the measured parameters indicated that the 30 cps group caused the greatest change from the control group. Tumors were found on 63% of the right femurs treated with the 30 cps electric field. The results indicate that the treatment with the alternating high frequency electric field causes a change in the bone metabolism. S.P.

N67-11717# Oak Ridge National Lab., Tenn.

ECOSYSTEMS, SYSTEMS ECOLOGY, AND SYSTEMS ECOLOGISTS

George M. Van Dyne Jun. 1966 33 p refs
(Contract W-7405-ENG-26)
(ORNL-3957) CFSTI: HC $2.00/MF $0.50

This paper defines and discusses ecosystems, systems ecology, and systems ecologists, in that order. Some properties of ecosystems and the ecosystem concept are given as a basis for defining the area of study called systems ecology. Problems, methods, tools, and approaches of systems ecology are considered in defining tasks, problems, and training of systems ecologists. The interdisciplinary nature of systems ecology research and the importance of computers in this research are considered. Examples of methods, concepts, and applications are drawn from a diverse body of ecological, natural resource management, and mathematical literature, which further illustrate the interdisciplinary nature of systems ecology. Advantages and limitations, with respect to total-ecosystem problems, of research by ecologists in universities, in state and federal experiment stations, and in national laboratories are compared. An example is given wherein, possibly under International Biological Program support, the skills and resources of these three groups of ecologists might be combined for integrated attack on nationally important ecosystem problems.
Author (NSA)

N67-11740*# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aerospace Medical Inst.

EXPOSURE OF TRADESCANTIA MICROSPORES TO PERIODIC VIBRATIONS OF 40–100 HERTZ

James C. Knepton, Jr. and Lynda J. Bales Oct. 1966 19 p refs
(NASA Order R-10-009-027)
(NASA-CR-79510; NAMI-981) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Slight differences ($P<0.05$) were found in the number of spherical chromosomal fragments observed in the experimental and control groups of microspores, the greater number being among the experimentals. It was also observed that specimens vibrated for a short period (3 min) exhibited larger effects than those vibrated for longer periods of time (15–60 min). No significant impairments of the mitotic mechanism or growth disturbances were observed. Future experimentation is indicated in which microspores would be subjected to periodic and random vibrations of higher frequencies (100–2000 Hz) and accelerations (up to 110 g).
Author

N67-11821*# Geophysics Corp. of America, Bedford, Mass.
INSTANTANEOUS MONITORING OF MULTICOMPONENT EXPIRED GASES
A. E. Barrington. Washington, NASA, Dec. 1966. 18 p refs (Contract NAS4-830)
(NASA-CR-619) CFSTI: HC $1.00/MF $0.50 CSCL 06B

Gas analyzers for aerospace applications, using time-of-flight and magnetic deflection mass spectrometers, are described. For reducing the pressure, a sorption pump for the capillary and an ion pump for the mass spectrometer were chosen. Details are given on the type of measurements taken, and schematics of the instruments are included. It was concluded that the time-of-flight mass spectrometer sensor is relatively simple mechanically, but the associated electronic circuitry is considerably complex. On the other hand, the magnetic deflection mass spectrometer sensor is more complicated mechanically, but simpler electronically. N.E.N.

N67-11827# Joint Publications Research Service, Washington, D. C.
SOLAR ACTIVITY AND LIFE PROCESSES
V. Yagodinskiy. 8 Nov. 1966. 10 p. Transl. into ENGLISH from Nauka i Tekhn. (Moscow), no. 5, May 1966 p 5–7
(JPRS-38538; TT-66-34963) CFSTI: $1.00

A narrative account is presented on the relation of tick-borne encephalitis epidemics and solar activity. It is pointed out that the encephalitis virus is comparatively scarce during the quiet sun, but the ticks become virus ridden at times of solar activity. The weather cycles, due to the solar sunspots, and their influence on tick bearing animals are mentioned. N.E.N.

N67-11832# Joint Publications Research Service, Washington, D. C.
PHYSIOLOGICAL ANALYSIS OF THE SO-CALLED FORESIGHT IN THE CHIMPANZEE
F. P. Mayorov and L. A. Firsov. 30 Nov. 1966. 7 p refs Transl. into ENGLISH from Nauchn. Soobshch. Inst. Fiziol. Akad. Nauk SSSR (Moscow), no. 3, 1965 p 112–116
(JPRS-38887; TT-66-35311) CFSTI: $1.00

Details are presented on experiments with chimpanzees to study the nature of their behavior at moments when some components of a standard problem were changed. Food, placed in a maze with a single exit, could only be obtained by using a stick. The animals were all right handed, and consistently achieved results more quickly when a counter-clockwise motion was required. It was noted that the behavior of the apes during the control trials was dissimilar, and that all animals secured the food more quickly in the second series. It was considered that against the background of a certain conditioned reflex activity, variation of some components of the problem is a weak stimulus for changing the form of motor activity or for inhibition of formed conditional reflexes. N.E.N.

N67-11836# Federal Aviation Agency, Washington, D. C. Office of Aviation Medicine.
HUMAN FACTORS IN GENERAL AVIATION ACCIDENTS
J. Robert Dille and Edward W. Morris. Jul. 1966. 9 p refs
(AM-66-27)

During the twelve months ending October 31, 1965, there were 122 fatal general aviation accidents in the Western Region in which the Regional Flight Surgeon's office was notified and the wreckage was located within one week. Autopsies were obtained on 86 pilots and blood alcohol determinations were obtained on 83 of these. No accidents were found to be definitely due to medical conditions but a psychiatric problem is the probable cause of one. In addition, 25 wore corrective lenses and 20 had other recorded physical defects. Drugs were found on three but were not found to be a causal factor; possibly significant barbiturate levels were found in two accidents. Blood ethyl alcohol levels ≥30 mg % were found in 17 (20.5%); five had levels greater than 250 mg %. The relationships of experience, occupation, local reputation and time of day to alcohol involvement are discussed. Carbon monoxide, agricultural chemicals, and fatigue are among other causes found for fatal accidents. The role of medical conditions, alcohol and pesticides are discussed for the few non-fatal accidents that were medically investigated. The development of human factors accident investigation is briefly discussed. Author

N67-11848*# Mayo Clinic, Rochester, Minn.
STUDIES OF THE EFFECTS OF ACCELERATION ON CARDIOVASCULAR AND RESPIRATORY DYNAMICS Semiannual Status Report, Apr. 1–Oct. 1, 1966
Earl H. Wood. 10 Nov. 1966. 9 p
(Grant NsG-327)
(NASA-CR-79912) CFSTI: HC $1.00/MF $0.50 CSCL 06S

On-line time-sharing electronic data processing and computer analysis techniques are discussed, along with programs developed for analyzing pressure data, accelerative force, respiration phases, cuvette oximetry, and indicator-dilution curves input to the computer in analog form during centrifuge runs. It is reported that analog vascular and pleural pressure data may be analyzed for mean, maximal, and minimal values, and cardiac output or stroke volume, heart rate, cycle length, duration of systolic ejection and peripheral resistance derived by real-time analysis of the contour of central aortic pressure pulses. Summary data are presented on regional pulmonary arterial–venous shunting during exposure to transverse acceleration, and on pleural and pericardial pressure measurements during G_x acceleration in primates. An experimental program is outlined for studying (1) acceleration effects on regional pulmonary blood flow using a roentgen videodensitometer, and isotopically labeled microspheres of variable specific gravity; and (2) a technique for dynamic measurements of ventricular volume and shape using biplane roentgen videometry. M.G.J.

N67-11851*# Pennsylvania State Univ., University Park. Dept. of Biophysics.
PHYSICS OF CELLULAR SYNTHESIS, GROWTH AND DIVISION Progress Report, Apr. 1–Sep. 30, 1966
7 Nov. 1966. 21 p refs
(Grant NsG-324)
(NASA-CR-79921) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Brief articles regarding the following research are presented: (1) CsCl density gradient centrifugation of intact bacterial cells; (2) hydrostatic pressure effects on macromolecular synthesis; (3) centrifugal fields–effect on macromolecular synthesis of *E. coli*; (4) reversion of mutagens; (5) hydrogen atom–amino acid interaction; (6) dose saturation in gamma-irradiated organic solids; (7) radiation effects on thymine and related purine derivatives; (8) free radical production by decay of tritium in nucleic acid pyrimidines; (9) photodynamic action at the molecular level; (10) breaks in DNA; and (11) bacterial growth in high sugar concentrations. Also reported is progress in microspectrophotometry instrumentation and in the construction of a cell culture laboratory. K.W.

N67-11858*# Florida Southern Coll., Lakeland. Southern Bio-Research Inst.
THE MALAISE OF SPACE-MAN AND ITS POSSIBLE RELATION TO SEROTONIN Semiannual Report, May 1–Oct. 31, 1966
31 Oct. 1966. 64 p refs
(Grant NGR-10-012-001)
(NASA-CR-79928) CFSTI: HC $3.00/MF $0.75 CSCL 06S

Preliminary data essential for the experiments with animals placed in a simulated high altitude air chamber are reported together with findings of an investigation concerning the effects of simulated high altitude air on blood serotonin and serum ascorbone concentrations. The data relate to normal animals of various genera and their deviations in blood serotonin concentrations under various

abnormal conditions, such as cancer and hypercholesteremia. Also given are data of blood concentration in normal men and cardiac patients. Preliminary tests with a simulated high altitude air chamber indicate that the blood serotonin concentration in rats was significantly increased at 30,000 feet. The increase was much less pronounced at the altitude of 20,000 feet. K.W.

N67-11884# School of Aerospace Medicine, Brooks AFB, Tex.
SPEED OF RECOVERY FROM CORIOLIS STIMULATION IN MOTION SICKNESS IN RELATION TO PILOTS AND NONPILOTS
Patrick J. Dowd Jul. 1966 4 p refs
(SAM-TR-66-63; AD-639598) CFSTI: HC $1.00/MF $0.50

Certain flight maneuvers, such as an aircraft banking and turning, can be simulated by the USAFSAM biaxial stimulator, resulting in a Coriolis effect. Motion sickness can easily be induced by Coriolis stimulation for both pilots and nonflyers. An ex post facto analysis of the rate of decay of vertical nystagmus was used to determine the differences between pilots and nonpilots who were sick or nonsick. Results implied that the more rapid the rate of decay of nystagmus, the more rapid the abatement of autonomic stimulation, which decreases the chances of summing activity over time to reach required levels for general visceral responses resulting in motion sickness. The findings demonstrate the effects of flying experience on the rate of decay of nystagmus elicited by a Coriolis stimulation. Author (TAB)

N67-11887# Picatinny Arsenal, Dover, N. J. Explosives Lab.
AN INVESTIGATION OF BIOLOGICAL SYSTEMS BY SLOW NEUTRON INELASTIC SCATTERING
H. P. Boutin Sep. 1966 58 p refs
(PA-TR-3387; AD-638991) CFSTI: HC $3.00/MF $0.50

Several systems of biological interest have been investigated by slow neutron inelastic scattering. The frequencies of molecular vibrations in a 40–800/cm range have been obtained for several polypeptides (polyglutamic acid (PGA), polyglycine, polyleucine). Under certain approximations, the frequency distribution g(mu) of phonons in the sample can be extracted from the scattered neutron intensity. This function g(mu) can in turn be used to calculate some of the thermodynamic parameters such as free energy, enthalpy, or specific heat. This has been applied to the study of the alpha-helix-random coil transition in PGA, and to the denaturation of bovine serum albumun (BSA). Preliminary results on the melting of keratin structure in 7-8 LiBr solution are also presented. Author (TAB)

N67-11899# Wisconsin Univ., Madison. Mathematics Research Center.
CONFIDENCE REGIONS FOR MEAN MEASUREMENTS OF HUMAN CHROMOSOMES
Marvin A. Kastenbaum Apr. 1966 13 p
(Contract DA-11-022-ORD-2059)
(MRC-TSR-656; AD-638635) CFSTI: HC $1.00/MF $0.50

A statistical analysis of data on human karyotypes is presented. The data represent lengths of the chromosome arms in several cells from the same individual. A bivariate vector of means is computed, and confidence regions are estimated for each chromosome. These regions are ellipses whose center is at the point specified by the mean lengths of the long and short arms. When all ellipses are plotted on the same grid, the over lap gives some indication of the inability to distinguish between chromosomes. Author (TAB)

N67-11922# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
A SELECTIVE REVIEW OF THE LITERATURE ON TACTILE SENSITIVITY: 1940–1965 Final Report, Oct.–Dec. 1965
Thomas J. Moore Apr. 1966 24 p refs
(AMRL-TR-66-50; AD-638718) CFSTI: HC $1.00/MF $0.50

The literature from 1940 to 1965 concerned with the tactile sense has been selectively reviewed. The neurophysiological, psychophysiological, and communicatory aspects of the tactile system were considered. In each of the three areas, representative studies have been reviewed and current trends of research have been indicated Author (TAB)

N67-11925# Karolinska Institutet, Stockholm (Sweden). Dept. of Cell Research.
AUTOFLUORESCENT GRANULES IN CELLS OF HUMAN DERMIS. II: HISTOCHEMICAL OBSERVATIONS
Gunnar D. Bloom and E. Martin Ritzen 1963 19 p refs
(Grant PHS-C-4716)
(AD-636695) CFSTI: HC $1.60/MF $0.50

Cells with autofluorescent granules are common in the dermal connective tissue of human skin. The cytoplasmic granules appear to be of lipo-pigment nature. The cells show phagocytic properties and it can therefore not be excluded that the cytoplasmic granular structures are ingested material. There are certain similiarties between the observed dermal autofluorescent cells (DAF-cells) and chromatophores (melanophages) of the dermis. Convincing histochemical evidence has not been obtained for the presence of catecholamines in these fluorescent cells, which has been suggested. Author (TAB)

N67-11938# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.
AVIATION MEDICINE REPORTS; AN ANNOTATED CATALOG OF OFFICE OF AVIATION MEDICINE REPORTS, 1961 THROUGH 1965
Mary Ellen Allen and Stanley R. Mohler Jan. 1966 33 p
(AM-66-1; AD-638732) CFSTI: HC $2.00/MF $0.50

An annotated catalog of Office of Aviation Medicine Reports is presented as a quick reference for those engaged in civil aviation and related activities. It provides an applied summary, Author Index, and Subject Index of each OAM Report published from 1961 through 1965 Author (TAB)

N67-11946*# Texas Inst. for Rehabilitation and Research, Houston.
THE EFFECT OF BEDREST ON VARIOUS PARAMETERS OF PHYSIOLOGICAL FUNCTION. PART X: THE EFFECT OF BEDREST ON THE CIRCULATORY RESPONSE TO A VALSALVA MANEUVER
C. Valbona, F. B. Vogt, D. Cardus, and W. A. Spencer Washington, NASA, Dec. 1966 17 p refs
(Contract NAS9-1461)
(NASA-CR-180) CFSTI: HC $1.00/MF $0.50 CSCL 06P

Experimental design of studies of the effect of bedrest included an evaluation of the performance of a controlled Valsalva maneuver before and after bedrest. This report presents the quantitative results of the changes in arterial blood pressure during the performance of a controlled Valsalva maneuver before and after bedrest by a group of thirteen individuals who praticipated in this study. An analysis of the data indicates that after 14 days of bedrest the Valsalva maneuver may trigger a greater adrenergic reaction to compensate for the decreased venous return in the phase of forced expiration. This adrenergic reaction was evident also in subjects who developed poor tolerance to passive tilt following bedrest. The findings suggest that a mechanism of orthostatic hypotension after bedrest must be explained on basis other than deficit in the autonomic nervous system of these individuals. Author

N67-11988*# Bio-Dynamics, Inc., Cambridge, Mass.
RESPONSES OF HEALTHY SUBJECTS TO STRESSES OF SELECTED ATHLETIC EVENTS Final Report, Jan. 1963–Jul. 1964
19 Jan. 1965 115 p refs
(Contract NAS9-1246)
(NASA-CR-65538) CFSTI: HC $4.00/MF $0.75 CSCL 06S

Electrocardiographic measurements were obtained by telemetry from 49 participants during athletic events. Physiological measures plus timed blood and urine samples were also collected at specified intervals prior to and subsequent to the events. The physiological data and biochemical analyses of the blood and urine samples provide normative data which are descriptive of the stress response of expert and novice athletes. Athletic events monitored were: auto racing, sky diving, polo, bullfighting, hockey, skiing, crew, and track. The selection of sports includes team versus individual competition, life endangering versus low injury events, and tests of strength and stamina versus agility and skill. For most of the sports, both expert and relative novice participants were monitored.
Author

N67-11985*# Hughes Research Labs., Malibu, Calif.
RESEARCH AND DEVELOPMENT PROGRAM FOR RADIATION MEASUREMENTS OF RADIOBIOLOGICAL HAZARDS OF MAN IN SPACE Summary Technical Report, 1 Aug. 1965–31 Jul. 1966
31 Jul. 1966 42 p refs
(Contract NAS2-2366)
(NASA-CR-73040) CFSTI: HC $2.00/MF $0.50 CSCL 06R

Data from experimental measurements of the center line depth dose distributions for protons with energies of 20, 45, 137, 220, 260, 630, and 730 MeV are presented and are discussed. The distributions for 20, 45, and 137 MeV protons are characterized by a gradual increase of dose with tissue depth, followed by a sharp peak as the protons approach the end of their range. In other work, spherical proportional counters with various electrode designs were investigated for measuring microscopic dose distributions; and the preparation of spherical silicon Au-i-Al detectors is described.
L.S.

N67-12009# Joint Publications Research Service, Washington, D. C.
OPTIMAL TEMPERATURE REGIMES FOR THERMOPHILIC CHLORELLA INVESTIGATED
I. V. Smirnov 22 Nov. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 167, no. 6, 1966 p 1405–1408
(JPRS-38731; TT-66-35155) CFSTI: $1.00

A study designed to determine the optimal temperature for growing the thermophilic strain of chlorella with varying intensities of artificial illumination is reported. Focused upon was the dependence of growth rate reduction on the intensity of illumination of a cell suspension temperature at 39°. It was found that: (1) with an increase in illumination intensity the temperature corresponding to the maximal growth rate of the culture is shifted toward higher temperatures; (2) the temperature shift as a function of illumination intensity may be expressed by the empirical relation

$$T_{max}(I) = 36° + \alpha(1 - e^{-\beta I}),$$

where $\alpha = 4.43°$, $\beta = 7.5 \times 10^{-6}$ erg^{-1}-cm^2-sec; and (3) to obtain maximal culture productivity with changes of the illumination intensity, it is necessary to vary the cell suspension temperature. If the range of variation of illumination intensity is small, for example, in the limits of $100–300 \times 10^3$ erg-cm^{-2}-sec^{-1}, then the cell suspension temperature may be stabilized at a single point corresponding to 39°. In this case the productivity is reduced by no more than one to two percent in comparison with the maximal.
S.C.W.

N67-12013# Joint Publications Research Service, Washington, D. C.
BIBLIOGRAPHY ON BIOASTRONAUTICS
L. I. Boreva and E. M. Panova, comp. 16 Nov. 1966 110 p refs Transl. into ENGLISH of the booklet "Ukazatel' Literatury, Aviakosmicheskaya Meditsina, Bioastronautika" Moscow, 1966 p 3–107
(JPRS-38661; TT-66-35086) CFSTI: $4.00

A bibliography of scientific literature on aerospace medicine and bioastronautics is reported. Cited are research in the following areas: biological, physiological and psychological effects of the space environment; problems of man–machine and life support systems; medical problems and pharmacology; toxicology; problems associated with selecting and training personnel; and research methods, biotelemetry, and data processing.
S.C.W.

N67-12030# Library of Congress, Washington, D. C. Aerospace Technology Div.
THE EFFECT OF SPACEFLIGHT FACTORS ON CENTRAL NERVOUS SYSTEM FUNCTIONS Surveys of Foreign Scientific and Technical Literature
Christopher H. Dodge and Janice L. Smith 4 Aug. 1966 42 p refs Summary of data
(ATD-66-99)

Reported is an annotated bibliography of Soviet scientific and technical literature on the isolated and combined effects of spaceflight acceleration and ionizing space radiation on the central nervous system. Cited are studies on respiratory changes during vibration; the comparative effects of neutron, proton, and gamma irradiation; the effect of radial accelerations on brain temperature; the effect of prolonged gamma irradiation on vestibular functions; and cerebral oxygen metabolism, bioelectricity, and conditioned reflex activity during vibration.
S.C.W.

N67-12035# Federal Aviation Agency, Oklahoma City, Okla.
PROBLEMS IN AEROMEDICAL CERTIFICATION: CARDIOVASCULAR RESPONSES TO EXERCISE FOLLOWING MYOCARDIAL INFARCTION
J. Naughton, K. Shanbour, R. Armstrong, J. Mc Coy, and M. T. Lategola Jun. 1966 8 p refs
(AM-66-17)

There has been much speculation about a cardiac patient's ability to respond to physical conditioning. In order to evaluate the quality of the cardiovascular adjustments of cardiac patients to exercise, 12 men who had recovered from well-documented episodes of myocardial infarction were evaluated with a work-capacity test while sedentary and after 8 months of regular, vigorous physical activity. Their responses were compared with those of 12 other cardiac patients and 12 healthy men tested in a similar manner at 8-month intervals. Prior to reconditioning, the 12 cardiac patients had blood-pressure and pulse-rate responses similar to those recorded in the two sedentary groups at comparable levels of energy expenditure. Following the reconditioning, however, these 12 patients had significantly lower levels of systolic and diastolic blood pressure ($P < 0.05$) and significantly lower pulse rates ($P < 0.05$) throughout testing. These results suggest that the asymptomatic cardiac patient with a well-healed myocardial infarction has the ability to respond to physical conditioning in a manner similar to that observed to occur in presumably healthy individuals. These cardiovascular adjustments following training reflect a more efficient cardiovascular mechanism for adjusting to physical stress.
Author

N67-12036# Federal Aviation Agency, Oklahoma City, Okla.
CLINICAL AVIATION MEDICINE: A PHYSICAL-CONDITIONING PROGRAM FOR CARDIAC PATIENTS Progress Report
John Naughton, Michael T. Lategola, and Kamal Shanbour Jun. 1966 11 p refs
(AM-66-21)

Twenty men with well-documented episodes of myocardial infarction participated in a physical-conditioning program for 3 months or longer during the past 2 years. The activity consisted of intermittent jogging, calesthenics, and competitive games conducted as 1-hour sessions 5 days a week. Average participation by each individual was 3 days a week. Nineteen patients returned to full employment; three were hospitalized five times for minor noncardiac complaints; ten have discontinued the program; and four have been vigorous participants for over a year. Three patients have died; two of presumed recurrent episodes of myocardial infarction and one of suicide. Two deaths have also occurred in an aged-matched group of sedentary cardiac patients but, they have had four more episodes of myocardial infarction. The results to date indicate that cardiac patients can be physically rehabilitated without fear of jeopardizing their clinical course. Author

N67-12073*# IIT Research Inst., Chicago, Ill., Astro Sciences Center.

MISSION REQUIREMENTS FOR EXOBIOLOGICAL MEASUREMENTS ON VENUS

W. H. Riesen and D. L. Roberts Sep. 1966 34 p refs (Contract NASr-65(06)) (NASA-CR-79756; P-16) CFSTI: HC $2.00/MF $0.50 CSCL 06C

As the initial biological exploration of Mars and Venus will be based largely on the knowledge and experience gained with terrestrial life forms, these data are briefly reviewed. A possible evolutionary sequence, expressed in terms of chemical and biological constituents in the earth's environment, is tabulated. Two major considerations in determining the possible existence of life on Venus are identified: the ability of the present Venusian environment to support life; and the plausibility of life, of a terrestrial or nonterrestrial type, originating, becoming established, and evolving. The environmental parameters on Venus are listed and compared with the conditions under which life exists on earth. The biological measurements which should be made in the early exploration of Venus are discussed; these include entry probes for detecting organic compounds and life forms, and atmospheric probes which can remain at given altitudes for several days. Among the conclusions drawn are: (1) Life could survive on Venus probably in localized biotic zones. (2) Venus should be treated as a biological preserve. M.G.J.

N67-12085# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.

THE ACHIEVEMENT OF THERMAL BALANCE AND ITS MAINTENANCE DURING ENVIRONMENTAL STRESS

P. F. Iampietro and Thomas Adams Jun. 1966 15 p refs (AM-66-23)

This paper describes in some detail the means, both physical and physiological, available to man for maintenance of thermal balance. It is also concerned with some aspects of thermal balance when work is performed in hot or cold environments and the enhancement of performance that thermal acclimatization imparts. Author

N67-12129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

SOIL STUDIES—DESERT MICROFLORA. XIII: IDENTIFICATION OF SOME ALGAE FROM ANTARCTICA

R. E. Cameron *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 123–133 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Algal species were found in all of the 100 specimens collected in Antarctica, and detailed microscopic examination was made of 21 of these. Filamentous blue-green species accounted for most of the algae; and the most frequently observed were several varieties of oscillatoriaceae. Green algae were in lesser abundance, and Protococcus grevillei was found in 11 of the 100 specimens. Several of the specimens included diatoms. Most of the Antarctica algae are mesophilic or hydrophilic species which grow and reproduce when water is available. Protective mechanisms observed in some of the algae include lichenization, brownish pigmentation, increased amount and consistency of sheath or matrix materials, lamellation, and granule formation. Many of the 21 algae examined for fluorescence microscopy showed the red fluorescence of viable chlorophyll. Routine culture techniques did not promote the growth of these algae, although the cells remained viable throughout the incubation period. M.W.R.

N67-12152*# National Aeronautics and Space Administration, Washington D. C.

MORPHOLOGICAL CHANGES OF VARIOUS PERIPHERAL NERVOUS SYSTEM COMPONENTS UNDER THE INFLUENCE OF IONIZING RADIATION OF THE ORGANISM [O MORFOLOGICHESKIKH IZMENENIYAKH RAZLICHNYKH KOMPONENTOV PERIFERICHESKOY NERVNOY SISTEMY PRI DEYSTVII NA ORGANIZM IONIZIRUYUSHCHEY RADIATSII]

V. V. Anisimova-Aleksandrova Nov. 1966 10 p refs Transl. into ENGLISH from Med. Radiol. (Moscow), v. 4, 1959 p 309 (NASA-TT-F-10605) CFSTI: HC $1.00/MF $0.50 CSCL 06R

Nerve elements in the dura mater and the eye muscles of rabbits, rats, and guinea pigs subjected to Co^{60} irradiation were investigated. The highest radiosensitivity in the dura mater was manifested by the afferent nerve conductors, whose cylinders disintegrated 2 to 3 days after irradiation. Sympathetic fibers were found to be more resistant. The sensory nerves and their endings remained intact in the eye muscles while, at the same time, the motor nerve fibers and their terminal ramifications in the motor end plates appeared to be the least resistant and exhibited various degrees of injury up to complete degeneration and lysis of the end plate neurofibrillar apparatus from which only the protoplasmic soles were left. The elements of the peripheral nervous system exhibited a considerable reaction to the influence of ionizing radiation, but the radiosensitivity exhibited by the various system components is far from being uniform. Aurhor

N67-12192# Southwest Research Inst., San Antonio, Tex. Dept. of Physical and Biological Sciences.

THE EFFECTS OF IONIZING RADIATION ON OXIDATION STATES OF BIOLOGICAL SYSTEMS Final Report, Jul. 1965–Jul. 1966

Donald E. Johnson, James W. Register, Jr., William H. Storey, Jr., and James N. Bollinger 31 Jul. 1966 54 p refs (Contract AF 41(609)-2816) (SRI-05-1755; AD-639192) CFSTI: HC $3.00/MF $0.50

Changes in the oxidation state of biological systems as a function of ionizing radiation were studied by measuring the activity of two metalloenzymes and by evaluating electron spin resonance signals produced by mitochondria. The specific activity of liver cytochrome oxidase and xanthine oxidase was not altered in mice exposed to total-body irradiation of 150 to 22,500 rad. Iron (Fe(II)), molybdenum (Mo(V)), and free radicals (probably flavoquinones) yielded the most predominant signals in electron spin resonance analysis of liver mitochondria isolated from both irradiated and control mice. Both the electron spin resonance and cytochrome oxidase data suggest that the electron transport system is not damaged by the levels of ionizing radiation used in this investigation. The fact that molybdenum electron spin resonance signals occur in the mitochondrial preparations and that preliminary data indicate this metal undergoes oxidative changes due to radiation indicates the need for more extensive investigation of the relationship between this metal and ionizing radiation. Author (TAB)

N67-12201*# Consultants and Designers, Inc., Arlington, Va.

AN IMPORTANT CONTRIBUTION TO SPACE MEDICINE: SOME RESULTS OF THE EXPERIMENT ON THE AES "COSMOS-110" [VAZHNYY VKLAD V KOSMICHESKUYU MEDITSINU]

V. Pravetskiy, N. Gurovskiy, B. Yegorov, and A. Kiselev 19 May 1966 4 p Transl. into ENGLISH from Pravda (Moscow), no. 137, 17 May 1966 p 6
(Contract NAS5-9299)
(NASA-CR-80181; ST-PR-SM-10489) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Physiological observations and experiments on two dogs during prolonged spaceflight are reported. Results of the Cosmos-110 space experiments showed an increased calcium content in urine and blood of the dogs; this calcium washout was confirmed by X-ray investigation of their bones. An extreme weight loss of the animals despite adequate food consumption was attributed to dehydration and muscular mass expense. The animals' cardiovascular activity stabilized after 10 to 14 days of weightless orbiting after initial sharp frequency oscillations. Gastrointestinal disruptions observed in both dogs upon landing ceased after 6 to 8 days. G.G.

N67-12209*# Northrop Space Labs., Hawthorne, Calif.
INVESTIGATION OF PEROGNATHUS AS AN EXPERIMENTAL ORGANISM FOR RESEARCH IN SPACE BIOLOGY Progress Report, 1 Jul.–30 Sep. 1966
R. G. Lindberg 30 Sep. 1966 25 p refs
(Contract NASw-812)
(NASA-CR-80173; NSL-64-29-12) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Pocket mice were studied for their regulatory body temperature mechanisms in hypoxic atmospheres, and their responses to extreme environments in controlled chambers. It was found that the pocket mice possessed a critical body temperature of 22–24°C during cooling and warming cycles. Hypoxia induced in the animals a state of deep torpor; this state did not affect their circadian rhythm of arousal. A body temperature of 9.1°C in an ambient of 6.8°C was compatible with natural rewarming processes. Water balance and food consumption of the mice was not disturbed significantly in a dry environment if an adequate diet of high oil content seeds was provided. It was also demonstrated that pocket mice could be maintained under 100% oxygen reduced pressure for an extended period of time if the animals possessed a minimum weight. A daily period of torpor was documented in a pocket mouse that was exposed to oxygen concentrations from 14–46%. G.G.

N67-12225*# Miami Univ., Coral Gables, Fla. Inst. of Molecular Evolution.
[INVESTIGATIONS IN SPACE-RELATED BIOLOGY, INCLUDING MOLECULAR EVOLUTION AND RELEVANT ASPECTS OF THE EXTRA-TERRESTRIAL] Annual Report, 1 Jun. 1965–30 Sep. 1966
Sidney W. Fox 30 Sep. 1966 72 p refs
(Grant NsG-689)
(NASA-CR-79299; AR-2) CFSTI: HC $3.00/MF $0.75 CSCL 06C

Research accomplishments are reported in investigations of space related biology. A demonstration was made of heterotrophic proliferation of proteinoid particles which suggests how whole primitive systems could begin. It was found that proteinoids containing protein like proportions of all proteinogenous amino acids can be produced. Evidence was obtained which suggests that thermal proteinoids tend to be approximately as heterogeneous as unfractionated serum proteins. Stoichiometric relationships were found between thermal histone-like polymers and RNA. Hormonal activity was found in thermal polyamino acids, and it was demonstrated that the sea urchin egg lacks "fertilization antigens" at the egg surface. An experiment verified that conversion of multivalent to univalent fertilizin involves fragmentation of multivalent fertilizin into a least four large subunits. A study of fish sperms was conducted, and confirmed by thin sectioning that most species lack acrosomes. It is reported that a comparative, ultrastructural study of crustacean sperms was completed. C.T.C.

N67-12237*# California Univ., Berkeley. Dept. of Nutritional Sciences.
CLINICAL NUTRITIONAL STUDY OF MINIMUM PROTEIN AND CALORIC REQUIREMENTS FOR MAN Annual Report, Sep. 1964–Sep. 1965
Sheldon Margen and Doris Howes Calloway Sep. 1966 286 p refs
(Grant NGR-05-033-068)
(NASA-CR-79394) CFSTI: HC $8.00/MF $1.50 CSCL 06P

Three sets of "penthouse" experiments were conducted in a nutritional study of the minimum protein and caloric requirements for man. The first was a 60-day study divided into 4 major 15-day metabolic periods each of 3 minor periods of 3-, 6-, and 6-day duration. A total nitrogen balance study on an adequate protein diet was performed, and the total endogenous nitrogen losses were determined on as close to zero protein intake as possible. In the zero protein diet, protein was removed, carbohydrate was substituted for protein to maintain calories constant, and all other dietary constituents were unchanged. The second study was an 88-day investigation divided into 5 major metabolic periods (the first of 12-day duration and the remainder of 18-day duration), each of 3 minor periods of 6-day duration, and was a continuation of the first "penthouse" study. The total balance on an adequate protein diet and the minimum endogenous losses on a protein free diet were determined, and an attempt was made to maintain nitrogen equilibrium in subjects when they were given dietary protein at the level of the minimum endogenous loss. The third study was utilized to obtain further control data to increase the observations of the first two studies, and to test the nutritional adequacy of the Gemini diet. C.T.C.

N67-12250*# Naval Medical Research Inst., Bethesda, Md. Dept. of Microbiology.
EFFECTS OF HIGH AND LOW BAROMETRIC PRESSURES ON SUSCEPTIBILITY AND RESISTANCE TO INFECTION Quarterly Status Report, 1 Jul.–30 Sep. 1966
Francis B. Gordon 30 Sep. 1966 17 p
(NASA Order R-21-010-010)
(NASA-CR-80119; SC-R-21-010-010) CFSTI: HC $1.00/MF $0.50 CSCL 06M

The effect of prolonged increased oxygen tension at one atmosphere on enteric flora of mice was studied to investigate barometric pressure action on their susceptibility and resistance to infection. The completion of special chambers for holding mice under increased pressure, up to 95 psig, permitted initiation of a new series of experiments at this pressure. Analytical data are tabulated on stool cultures of mice in three types of gaseous environment. Numbers of bacteria per gram are listed for: *E. coli* (aberrant), slow lactose fermenters, *Klebsiella*, *Lactobacillus* (anaerobic and colony type), and *Bacteroides* of the colony type. Data are recorded for the effect of pressure on susceptibility of mice to mouse pneumonitis agent, as well as for pyruvic oxidase of meningopneumonitis agent (response to catalase). R.U.

N67-12255*# Space-General Corp., El Monte, Calif.
PHOTOSYNTHETIC HALOPHILES FROM OWENS VALLEY Final Report
31 Aug. 1966 37 p refs
(Contract NASw-1294)
(NASA-CR-80104; SGC-917FR-1) CFSTI: HC $2.00/MF $0.50 CSCL 06F

Studies of growth of a halophilic, anaerobic, photosynthetic bacteria from an halite–thenardite–trona evaporite deposit have led to an increased understanding of the behavior of organisms under an extremely hostile environment. This small *Chromatium* was found to exist in small pockets in the crystal with dimensions approximately equal to the organism. The growth cycle of the organism in moving from log to log stage involves oxidation of sulfide in the brine, the formation of a swollen cell, and finally the reduction in size to the normal short rod. A remarkable tolerance to

temperature extremes is shown by the *Chromatium*. Temperatures as high as 180°C have been resisted for short periods of time and 110°C or −35 to −55° storage appears to have little deleterious effect on growth. These phenomenological studies strongly suggest the need for mechanistic investigations of the mode of water introduction under extreme environments, and of the mechanism of tolerance to extreme temperatures and pressures. Author

N67-12256*# California Univ., Berkeley. Space Science Lab.
CHEMISTRY OF LIVING SYSTEMS Semiannual Report, May 1–Sep. 30, 1966
Thomas H. Jukes 30 Sep. 1966 18 p refs *Its* Ser. No. 7 Issue No. 60
(Grant NsG-479)
(NASA-CR-79738) CFSTI: HC $1.00/MF $0.50 CSCL 06A

In a program to investigate the mechanisms by which life resists environmental extremes, technological progress directed toward certain aspects of the fundamental biochemical mechanisms of heredity and gene expression, their adaptation to environmental extremes, and their possible relationships to the origin and development of life are reported. Experiments are reported on: protection mechanisms of deoxyribonucleic acid /DNA/, thermostable proteins, ribonucleic acid /RNA/ polymerase properties, chromosome replication in *B. subtilis*, metabolic regulation in *E. coli*, optical rotary dispersion, X-ray scattering, and birefringence of DNA and RNA, and peptide chain synthesis. Experimental results are also presented on: optical properties of viruses, mutagen action on TMV and TMV–RNA, thymine metabolism in *E. coli*, and other related areas. R.U.

N67-12281# School of Aerospace Medicine, Brooks AFB, Tex.
PHYSIOLOGY OF SLEEP AND CLINICAL ASPECTS OF SLEEP THERAPY, PART I
Rudolf Baumann [1966] 76 p refs Transl. into ENGLISH of the German Publ. "Physiologie des Schlafes und Klinik der Schlaftherapie" Berlin, Volk und Gesundh., 1963
(SAM-TT-G-569-0666; TT-66-62137; AD-637751) CFSTI: HC $7.60/MF $0.75

Contents: Sleep and internal inhibition; Is there a sleep center; Importance of cortical and cortico-autonomic regulation in sleep; Acquired conditioned sleep reflexes and foci of arousal; Foci of arousal and dreaming; Foci of arousal and hypnosis; Sleep theories; Mineral metabolism and electrobiologic processes in fatigue or sleep; The EEG in sleep and wakefulness; Cortico-autonomic regulation in sleep and wakefulness; Sleep and its connection with corticoviscoral regulation; Psychosomatic medicine; Therapeutic use of protracted sleep. TAB

N67-12288# Army Chemical Center, Edgewood, Md.
EFFECT OF ACETIC ANHYDRIDE IN ANHYDROUS DIOXANE ON C-TERMINAL RESIDUES OF PEPTIDES, MARCH–JUNE 1966
Norwood K. Schaffer and Richard A. Balskir Sep. 1966 9 p refs
(EATR-4038; AD-638755) CFSTI: HC $1.00/MF $0.50

The reaction of 20 dipeptides, 2 tripeptides, and 1 heptapeptide with acetic anhydride in anhydrous dioxane was studied. After 6N HCl hydrolysis the yield of the c-terminal residue was less than that of the penultimate residue in all peptides except three of the dipeptides. The yield of the penultimate residue in the two tripeptides was less than that of the n-terminal residue. Tyrosyl arginine yielded ornithine to partly account for the lost arginine. These results suggest that the acetic anhydride-dioxane reaction can be used as a subtractive method for identifying c-terminal amino acid residues in some peptides. Author (TAB)

N67-12298# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF HYDRAZINE ON BLOOD GLUCOSE AND MUSCLE AND LIVER GLYCOGEN IN THE ANESTHETIZED DOG Progress Report, Mar.–Nov. 1966
Gale D. Taylor (M.S. Thesis–Texas A&M Univ.) Mar. 1966 17 p refs
(SAM-TR-66-12; AD-633164) CFSTI: HC $1.00/MF $0.50

Intravenous injection of diluted hydrazine (25 mg./kg.) into anesthetized dogs caused prompt elevation of blood glucose levels, which reached a maximum in about 2 hours and decreased progressively during 4 hours thereafter. Liver glycogen levels fell rapidly during the first 4 hours after injection of hydrazine. Depletion of liver glycogen stores was associated with severe hypoglycemia and some depletion of muscle glycogen. Packed cell volume progressively increased after hydrazine administration. Microscopic examination of liver tissue from treated dogs showed swelling of hepatic cells and apparent fatty infiltration. Sections of liver stained with PAS confirmed the rapid glycogen depletion. It is postulated that hydrazine affects the carbohydrate concentration of various tissues by a primary insult to the glycogenetic-glycogenolytic mechanism of the liver. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N67-11342*# General Dynamics Corp., San Diego, Calif.
LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
R. C. Armstrong Washington, NASA, Nov. 1966 587 p refs
(Contract NAS1-2934)
(NASA-CR-614) CFSTI: HC $6.25/MF $2.50 CSCL 06K

The prototype physical–chemical life support system is described which provides reclamation and reuse of water and oxygen for a four-man crew and which maintains a safe, comfortable atmosphere in a simulated spacecraft cabin. Details are presented on the subsystems, the tradeoff techniques, the test procedures, and the analyses. The overall system, subsystem, and procurement specifications are given, and the subsystems are evaluated. It was concluded that the life support system was operationally demonstrated. N.E.N.

N67-11415# Joint Publications Research Service, Washington, D. C.
THE COLLISION OF CONCEPTS AND IMAGES OF PERCEPTION AS A CAUSE OF EMERGENCY SITUATIONS IN FLIGHT
B. S. Alyakrinskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 30 (See N67-11401 02-04) CFSTI: $8.40

The complex visual-motor-vestibular-tactile act connected with reading of piloting and navigational instruments was analyzed experimentally. It was shown that an artificially created collision of a concept and a perceived image can cause an abrupt disturbance of the coordinated activity with respect to spatial position control of the test object. The coordinated motor acts of the individual became jerky and chaotic and parts of them were not completed. G.G.

N67-11429# Joint Publications Research Service, Washington, D. C.
AGE LIMITATIONS ON FLIGHT PERSONNEL
A. N. Babiychuk *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 53–56 (See N67-11401 02-04) CFSTI: $8.40

Several medical studies on physiological, physical, and psychic changes due to aging are reviewed in an attempt to determine age limits for flight personnel. The studies show that in rendering a verdict as to the physical fitness of a given pilot for flight activity, it is necessary to consider his physical condition and actual physical working ability rather than his age. Most of the functional and physiological changes found in flight personnel over 40 years of age were neither pathological nor obstacles to their flying activities. R.N.A.

N67-11445# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF THE FUNCTIONAL INTERACTION OF ANALYZER (VISUAL, ACOUSTIC, AND TACTILE) IN FLIGHT PERSONNEL DURING THE PROCESS OF PROLONGED FLIGHTS

E. V. Bondarev, G. I. Gurvich, T. T. Dzhamgarov, V. A. Yegorov, V. L. Marishchuk et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 85–86 (See N67-11401 02-04) CFSTI: $8.40

The throughput capability of analyzers used for judging the activity of flight personnel during prolonged flight was evaluated. The test subjects in random order were subjected to visual, acoustic, and tactile stimuli to which they were supposed to react as quickly and correctly as possible by pressing the appropriate button. The time of a simple motor reaction and of the reaction of selection, the number of errors, the amount of processed information, the throughput capability, and the time for processing a unit of information were calculated. Results indicate that for light stimuli during the first 9 hrs of flight, the throughput capacity gradually increased with a subsequent reduction at the 15th hr of flight, and drops regularly as the duration of flight increased. The relation of fatigue to responses to stimuli are discussed. L.S.

N67-11453# Joint Publications Research Service, Washington, D. C.

SOME PROBLEMS OF THE SELECTION OF CANDIDATES FOR A SPECIAL CONTINGENT

P. V. Buyanov, A. V. Galkin, V. G. Terent'yev, Ye. Ye. Sheludyakov, N. V. Pisarenko et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 99–100 (See N67-11401 02-04) CFSTI: $8.40

A methodical approach to selecting flier and astronaut candidates is discussed, based on evaluations of actual procedures used. The selection method used is conducted in three stages: 1) an initial ambulatory selection, 2) stationary examination at special medical facilities, and 3) elimination during the first months of professional activity. The main reasons for rejection at each stage are outlined. These included ailments of the otorhinolaryngological organs, internal diseases, vestibular-vegetative weakness, anomalies of development, and degenerative changes of the spine. During recent years rejection during the second stage (which was 50% of the candidates who had passed the first stage) was reduced as a result of a stricter approach toward the candidates during the initial examination. About 10% were found unsuitable during the third stage due to functional changes caused by professional activity. The data obtained are used to predict the capabilities of an individual under his work load and environmental conditions. L.S.

N67-11454# Joint Publications Research Service, Washington, D. C.

THE EXPERIMENTAL STUDY OF THE DYNAMICS OF CONFLICT

A. F. Bystritskaya and M. A. Novikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 101–102 (See N67-11401 02-04) CFSTI: $8.40

The nature and causes of conflict situations in performing group activity were experimentally investigated through the use of a homeostatic scheme of connections (called Blind-Apodal) which models group activity conflict. An external signal from a control panel was introduced to discoordinate all instruments to create mathematically incompatible conditions of solution. In the first stage of the experiment the group was irradiated and skill was tested; in the second stage, discoordinating interference was introduced during the solution of the problems. The sum of the modules of the activity parameters of the operators and the vegetative reactions of the test subjects during the solution of the problems were recorded. The results obtained demonstrate that the introduction of discoordinating interference upon the approach of the system to a stable condition causes conflict tension accompanied by neurotic reactions which are expressed by disturbance of the developed dynamic stereotype to include the loss of a skill and inability to decide, change of behavioral reactions, and change of the emotional-vegetative background. Other comments on the behavior of the human test subjects are also discussed. L.S.

N67-11461# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE POSSIBILITY OF CREATING A CONFLICT SITUATION IN THE CASE OF THE INTERDEPENDENT GROUP ACTIVITY OF OPERATORS BY THE METHOD OF MATHEMATICAL MODELING

V. K. Vasil'yev, F. D. Gorbov, M. A. Novikov, A. B. Sauvin, and Ye. Z. Tambiyev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 115–116 (See N67-11401 02-04) CFSTI: $8.40

Man–machine problems are discussed, and reports on the properties of one operator interacting with a technical system are listed. A homeostat is also mentioned; this device makes it possible to conduct experimental investigations of the behavior of an operator in a group, and to obtain quantitative data required for constructing a mathematical model of the interdependent work of the operators. Two approaches to studying the tactics of the operators on a homeostat are identified as the work of the operators in a nonconflict situation when the problem in principle can be solved, and in a conflict situation when the task in principle cannot be solved. M.G.J.

N67-11471# Joint Publications Research Service, Washington, D. C.

MOTOR ACTIVITY AS ONE OF THE CRITERIA FOR EVALUATING THE READINESS OF A FLIER FOR FLIGHT

A. A. Vorona, N. M. Pavlenko, and A. I. Serikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 131–132 (See N67-11401 02-04) CFSTI: $8.40

Findings from a study on the individual differences in the motor activity of fliers are outlined. The concept of a motor working dynamic stereotype was considered in relation to pilot actions in a preflight check of the controls. It was established that these actions consist of individual movements performed in strict sequence, and that multiple repetition leads to their combination in a definite set of motor operations. It was concluded that motor activity is a sensitive indicator of change in the functional condition of a pilot during flying, and that motor working dynamic stereotypes are a suitable criteria for evaluating the flight readiness of a pilot. M.G.J.

N67-11473# Joint Publications Research Service, Washington, D. C.

ALGORITHMS AND DIAGRAMS OF THE ACTIVITY OF THE OPERATOR OF A SYSTEM OF AUTOMATIC CONTROL AND MANAGEMENT

A. I. Galaktionov, I. M. Panasenko, and L. V. Fatkin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 136–137 (See N67-11401 02-04) CFSTI: $8.40

A method of constructing and analyzing an algorithm is proposed as a solution to the problem of the correct distribution of the functional duties between the operator and the automatic

apparatus of a control and management system. Optimum coordination of the operator with the automatic apparatus and technical components of the system is also considered. A brief outline of the approach used is presented. M.G.J.

N67-11478# Joint Publications Research Service, Washington, D. C.

WAYS FOR EXPERIMENTAL STUDY OF THE REACTIONS OF ANTICIPATION

S. G. Gellershteyn *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 141–142 (See N67-11401 02-04) CFSTI: $8.40

Several experiments are listed, in which the stimulus used was a situation with a latent tendency; the test subject upon detecting this tendency guessed the logic of the course of events, thereby preparing himself for reactions to the developing future. These tests included guessing the time of the onset of coming events, anticipation of several possible changes, false anticipation modeling conflicting situations, and guessing the hidden logical connection involved in a sequential series of occurrences. M.G.J.

N67-11480# Joint Publications Research Service, Washington, D. C.

RECEPTION AND PROCESSING OF COMPLETE AND CONDENSED REPORTS

Ye. L. Ginzburg, V. A. Pestova, V. G. Stepanov, and V. N. Shcherbakova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 150–151 (See N67-11401 02-04) CFSTI: $8.40

Efforts to find and formulate rules for condensing command–informational textual communications are outlined. The development of two condensation algorithms is reported, and summary data are given on experiments conducted to check the effectiveness of perception of the condensed proposals. M.G.J.

N67-11488# Joint Publications Research Service, Washington, D. C.

THE HOMEOSTATIC PRINCIPLE OF MODELLING GROUP ACTIVITY

F. D. Gorbov, M. A. Novikov, A. F. Bystritskaya, A. A. Gerasimovich, and M. A. Kareva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 162–163 refs (See N67-11401 02-04) CFSTI: $8.40

Three human operators were studied in terms of their individual and intergroup activities via the use of a homeostatic model. The strength of mutual ties is found to influence the strategy of the group situation in both visual and motor activities; and conflicts are found to be dependent upon the psychological characteristics of the individuals, as well as the situation which arises at any given moment. M.W.R.

N67-11489# Joint Publications Research Service, Washington, D. C.

ASPECTS OF THE PHYSICAL TRAINING OF A SPECIAL CONTINGENT WITH RESPECT TO CERTAIN EXTREME EFFECTS

F. M. Gorskiy and V. K. Khukhlayev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 168–169 (See N67-11401 02-04) CFSTI: $8.40

Five persons involved in mental work were studied to improve their general physical training and the functional capabilities of their systems in order to develop special physical qualities and skills that would facilitate human tolerance to various extreme conditions. Special exercises were developed and used in morning exercise periods over approximately a month. Results noted from these exercises, which were intended to increase the resistance of the vestibular analyzer and to develop equilibrium ability, include: (1) lowering of the pulse rate by 10 to 15 beats/min during activity, and by 6 to 8 beats/min during rest; (2) increasing vestibular resistance by 1%; and (3) increasing ability to walk on a 6-cm in diameter bar. Other improvements noted include improvement in respiration control and in muscle tolerance. M.W.R.

N67-11496# Joint Publications Research Service, Washington, D. C.

STUDY OF REGIMES OF VITAL ACTIVITY OF A GROUP OF TEST SUBJECTS IN AN ISOLATION CHAMBER

N. N. Gurovskiy, B. A. Dushkov, and F. P. Kosmolinskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 180–181 (See N67-11401 02-04) CFSTI: $8.40

Results of two 15-day isolation chamber experiments, with three persons participating in each, indicate that the more difficulty a person has in tolerating a regime, the more he will depart from his customary reactions. In one experiment, one test subject slept, the second rested, and the third was on watch when observations were made; with each individual alternating between eight hours of sleep and four hours of work. The second experiment employed a six-hour period of sleep, a three-hour period of duty, another six-hour sleep, and a three-hour period of relaxation. M.W.R.

N67-11500# Joint Publications Research Service, Washington, D. C.

CHANGES IN THE PERFORMANCE OF AUTOMATIC AND NON-AUTOMATIC MOVEMENTS IN SIMULTANEOUS PROCESSING OF SENSORY INFORMATION

Yu. K. Dem'yanenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 187–188 (See N67-11401 02-04) CFSTI: $8.40

When additional sensory information is introduced during the performance of tasks which require complex coordinated movements, there is an increase in rate of work above that which is considered optimum. Simultaneously, there is a decrease in the qualitative indices of work. This capacity for so-called differentiated inhibition is interrupted less in persons who have been given more physical training. Particularly, in work involving a high degree of automatic movement, individuals with considerable physical training can perceive additional information. M.W.R.

N67-11514# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF HIGH TEMPERATURES ON THE FUNCTIONAL CAPACITIES OF MAN

A. V. Yeremin, V. I. Kopanev, A. N. Azhayev, N. A. Lysakov, and S. V. Zhadovskaya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 214–215 refs (See N67-11401 02-04) CFSTI: $8.40

Working ability in man in air temperatures of 40°, 60°, and 80°C is evaluated, and a lowering of ability is reported after a 60-minute stay at 40°C. Note is made of changes in the visual analyzer, thresholds of electrical excitability of the eyes, and weight of the tests subjects. An increase in body temperature of 0.3°C is noted, along with increased frequency of cardiac contractions. M.W.R.

N67-11515# Joint Publications Research Service, Washington, D. C.

THE STUDY OF THE SUPPLYING OF FLIGHT CREWS OF CIVIL AVIATION WITH CERTAIN FOODSTUFFS DEPENDING ON THE NEW CONDITIONS OF THEIR WORK

V. V. Yefremov, L. M. Solov'yeva, G. M. Makhkamov, V. Ya. Gilinskiy, A. G. Kozlova et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 216–217 (See N67-11401 02-04) CFSTI: $8.40

Food requirements and vitamin deficiencies among civilian flight personnel are discussed. In order to compensate for these deficiencies, which continue to exist after the crews return to land, it is recommended that diets include increased animal proteins, fruits, and vegetables; as well as reduced caloric content and administration of multiple vitamins. M.W.R.

N67-11516# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF INVESTIGATING THE WORKING CAPACITY OF AN OPERATOR UNDER CONDITIONS OF A PROLONGED STAY IN A DUMMY SPACE SHIP

S. G. Zharov, A. P. Kuz'minov, I. I. Kas'yan, D. G. Maksimov, V. F. Onishchenko et al *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 219–220 (See N67-11401 02-04) CFSTI: $8.40

Human reaction to prolonged isolated conditions was investigated in a simulated spacecraft. Following a 3-day stay, the general condition of test personnel does not change very much; working capacity decreases on the first day, but returns to normal for the second and third days. More pronounced lowering of work capacity is found during a 12-day simulated trip; with lowered capacities noted on the first, fifth, seventh, and eleventh days.
M.W.R.

N67-11519# Joint Publications Research Service, Washington, D. C.

PSYCHOPHYSIOLOGICAL ASPECTS OF THE ACTIVITY OF MAN IN AUTOMATED CONTROL SYSTEMS

N. D. Zavalova and V. A. Ponomarenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 224–225 refs (See N67-11401 02-04) CFSTI: $8.40

Pilot performance under stress conditions is considered in terms of adapting to conditions of increased activity, and the role of man in an automated control system is mentioned. Time characteristics, the level of physiological reserve, and quality of the activity are the criteria of working ability.
M.W.R.

N67-11527# Joint Publications Research Service, Washington, D. C.

THE SPEED OF THE PERCEPTION AND PROCESSING OF INFORMATION BY A PILOT UNDER ORDINARY AND EMERGENCY CONDITIONS

L. S. Isaakyan *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 239–241 (See N67-11401 02-04) CFSTI: $8.40

Methods for calculating the throughput capacity of pilots are developed for normal and emergency flight conditions. It is also shown that from the information theory viewpoint, the throughput capacity of a flier necessary for the perception and comprehension of an emergency situation in the form of an engine failure can be calculated as the product of the objective probability of the given failure for the magnitude, return time, and comprehension of the situation.
A.G.O.

N67-11529# Joint Publications Research Service, Washington, D. C.

VISUAL RECOGNITION OF IMAGES AND DETERMINATION OF THE DEGREE OF THEIR RESEMBLANCE

A. N. Kalinina, V. G. Stepanov, and Ye. I. Shugam *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 244–245 (See N67-11401 02-04) CFSTI: $8.40

A determination was made of the connection between recognition and the similarity of given images in the process of receiving and processing information by visual observation. Also investigated was the hypothesis that under certain conditions the last reception will receive the advantage with respect to rapidity of recognition without significant loss of accuracy. The investigations were conducted by giving a test subject a series of images with an etalon. A series with increasing similarity was then compiled, with each image given a number in the series. Distributions of the numbers given to a certain image by various test subjects were then constructed, and the mathematical expectations and dispersions of these distributions were calculated.
C.T.C.

N67-11531# Joint Publications Research Service, Washington, D. C.

SOME PROBLEMS OF THE AUTOMATION OF THE PROCESSING OF PHYSIOLOGICAL INFORMATION OBTAINED ON SPACE FLIGHTS AND ACCOMPANYING INVESTIGATIONS

A. P. Kalinovskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 248–249 (See N67-11401 02-04) CFSTI: $8.40

A brief discussion is presented of the decoding and scientific analysis of physiological information obtained from space flights. Emphasis is placed on relatively narrow problems in which information to be processed is presented in the form of electric signals coming to the input of an analyzing apparatus without recording at an intermediate carrier.
C.T.C.

N67-11534# Joint Publications Research Service, Washington, D. C.

ASPECTS OF SPEECH ASSOCIATIVE ACTIVITY UNDER CONDITIONS OF A LACK OF TIME AND THE PRESENCE OF INTERFERENCE CLOSE IN CONTENT TO A USEFUL SIGNAL

M. A. Kareva and M. A. Novikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 253–254 (See N67-11401 02-04) CFSTI: $8.40

The activities of test subjects under conditions of interference and time shortage are compared. The most typical kinds of oral associative disruptions are mentioned, and the reasons for their occurrence are examined. Experimental data are also presented from dynamic stereotype research.
A.G.O.

N67-11536# Joint Publications Research Service, Washington, D. C.

PROBLEMS OF DESIGNING THE LOCAL PROTECTION OF AN ASTRONAUT

O. N. Karpov, Ye. Ye. Kovalev, G. F. Nevskaya, and L. N. Smirennyy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 255 (See N67-11401 02-04) CFSTI: HC $8.40

A method for calculating local shielding is described which is based on the determination of shielding effectiveness of a given critical organ by the design elements of the ship, taking into account the screening of this organ by other parts of the human body. For the calculations use was made of the dose relation to the depth of the tissue for given thickness of the shielding. It is reported that results of the calculations show the possibility of saving weight when using local shielding.
A.G.O.

N67-11537# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE FREQUENCY-AMPLITUDE CHARACTERISTICS OF HEAT TONES USING MODERN ACOUSTICAL TECHNIQUES

A. M. Kirsanov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 259–260 (See N67-11401 02-04) CFSTI: $8.40

Emphasis is placed on a description of the identifying features of a system for studying cardiac tones and noises in man. This system is based on a variation of the spectral phonocardiographic method, in which the test subjects are located in a special acoustical chamber. The recording of sound phenomena connected with cardiac activity is then accomplished with the aid of a condenser microphone and a microphone amplifier.
C.T.C.

N67-11544# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF CONDENSING PHYSIOLOGICAL INFORMATION

V. I. Kozharinov, V. S. Magadov, and I. S. Shadrinsev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 270–271 (See N67-11401 02-04) CFSTI: $8.40

The problems connected with data storage and reduction posed by prolonged physiological experiments are pointed out. Two solutions are suggested: preliminary processing of information by isolating certain measured parameters from the processes under study; and distinguishing the most important results of the

experiment. It is noted that although a considerable reduction in the volume of recorded information will be attained, the diagnostic values of the experiment will not be reduced. L.E.W.

N67-11546# Joint Publications Research Service, Washington, D. C.

THE INFLUENCE OF A STRONG SOUND STIMULUS ON ACOUSTICAL PERCEPTION OF THE TONES AND SPEECH OF CIVIL AVIATION FLIGHT PERSONNEL

V. M. Kozin *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 274 (See N67-11401 02-04) CFSTI: $8.40

An investigation conducted to determine the adaptation of an auditory analyzer to the acoustic environment is reported. The experiment was based on working experience under given conditions related to the tones and speech of civil aviation flight personnel. Preliminary data on the abilities of the analyzer are briefly presented. L.E.W.

N67-11555# Joint Publications Research Service, Washington, D. C.

CHANGE OF THE MOTOR FUNCTIONING OF ATHLETES UNDER THE INFLUENCE OF THE CONDITIONS OF RESTRICTED MOBILITY

A. A. Korobova and G. G. Ratishvili *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 290–291 (See N67-11401 02-04) CFSTI: $8.40

The effect of multiday hypokinesis on the accuracy of performing a movement by weight lifters and distance runners was studied. A detailed description of the accuracy of the movement was provided by determining its dynamics under the influence of maximum loads (running on a treadmill for speed and endurance). It was concluded that many days of the effects of hypokinesis in athletes does not cause considerable changes in the degree of precision of the performance of movements, and that the regime of muscular activity and systematic training of the motor apparatus facilitates better tolerance of extreme factors. L.E.W.

N67-11581# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE USE OF THE METHODS OF THE THEORY OF INFORMATION FOR ESTIMATING THE ADAPTABILITY OF A HUMAN OPERATOR TO CHANGED DAILY REGIMES

A. N. Litsov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 338–339 (See N67-11401 02-04) CFSTI: $8.40

The relationship between the daily dynamics of physiological functions and man's ability to adapt to external environmental changes which affect the speed of reception and processing of information was studied using methods of the theory of information. On the basis of experimental data it was found that: (1) A pause by a human operator under artificial conditions involving distortion of the customary rhythm of life placed into action adaptive mechanisms which produced the dynamic stereotype applicable to the changed conditions; (2) On the basis of comparative data on the dynamics of the working ability with the daily periodicity of the physiological functions, it is possible to distinguish qualitative differences in the effect of different daily routines on the human organism; (3) Based on the degree of expression of the daily dynamics of working ability and the daily periodicity of the physiological functions it is possible to determine the time required for the adjustment of the human organism to a changed daily routine; (4) The directed and active nature of the adaptation of man to changed daily routines puts the process of adaptation in a state of dependence on the qualities of will of the personality; and (5) The dynamics of the output capacity of an operator which artificially characterize the success of human activity under conditions of changed routines are a valuable indicator of working ability. S.C.W.

N67-11583# Joint Publications Research Service, Washington, D. C.

COMPARATIVE HYGIENIC CHARACTERISTICS OF CIVIL AVIATION AIRPLANES AND HELICOPTERS

A. Ya. Loshak, V. Ya. Gilinskiy, and A. G. Kozlova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 342 (See N67-11401 02-04) CFSTI: $8.40

Presented are results of a comparative study on the effects of air environment (microclimate, products of oil pyrolysis, etc.) and physical factors (noise, vibration, ionizing and radio frequency radiation) on the hygienic characteristics of aviation equipment used with helicopters and passenger airplanes. S.C.W.

N67-11593# Joint Publications Research Service, Washington, D. C.

SHIFTS IN THE STRUCTURE OF THE SYSTOLIC PART OF A PHONOCARDIOGRAM AND A BALLISTOCARDIOGRAM UPON A CHANGE OF THE RESISTANCE TO RESPIRATION

A. G. Mershchikov, I. A. Aleshin, and R. B. Chanysheva *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 360–361 (See N67-11401 02-04) CFSTI: $8.40

Using a respiratory device resembling a gas mask, healthy males were tested to determine the effect of increased resistance to respiration on the characteristics of phonocardiograms and ballistocardiograms. With an increase of resistance to respiration, changes in the duration of segments and intervals and slight changes in sound oscillations were observed in phonocardiograms. Analysis of ballistocardiograms showed that upon additional resistance, there were changes of interval duration, amplitude, ratios, and ballistic coefficients. Data from phonocardiographic and ballistocardiographic studies indicated that upon resistance to respiration, changes of the pumping function of the heart involve not only changes in the strength and rhythm of its contractions, but also the structure of the cardiac cycle. S.C.W.

N67-11600# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF THE FORMATION OF THE HABITATIONAL ENVIRONMENT OF THE CABIN OF A SPACE SHIP

Yu. G. Nefedov, S. N. Zaloguyev, V. M. Shilov, and V. V. Borshchenko *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 372–373 (See N67-11401 02-04) CFSTI: $8.40

Consideration is given to bacterial contamination of the living environment within a sealed space cabin and certain shifts in the immunological reactivity of the human organism. The study of mutual exchange processes of microorganisms between people is also briefly mentioned. A.G.O.

N67-11613# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF INCREASING THE RELIABILITY OF THE WORK OF OPERATORS BY THE METHOD OF DIRECTED PHYSICAL TRAINING

I. I. Petrushevskiy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 399–400 (See N67-11401 02-04) CFSTI: $8.40

Since the effectiveness of using equipment is determined to some extent by human factors, data obtained from experimental investigation of the activity of radio telegraph operators and vehicle drivers were analyzed for operator reliability. It is considered that physical training can be employed successfully to increase working ability directly during operator work tasks, and also to better prepare subjects for future tasks. R.L.I.

N67-11618# Joint Publications Research Service, Washington, D. C.

EXPERIENCE IN USING AN ELECTRONIC COMPUTER TO PREDICT THE ACTION OF EXTRA STIMULANTS UNDER CONDITIONS OF SPACE FLIGHT

A. K. Popov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 407–408 (See N67-11401 02-04) CFSTI: $8.40

The multiple presentation of a limited number of stimuli observed during space flights that cause suppression of the orientational reflex, and the negative effect on the process of inhibition on the functional state of the astronaut analyzers are mentioned. The electronic computer model of the inhibition process is presented in connection with prediction of the action of extra stimulants under space flight conditions. R.U.

N67-11641# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF THE OPERATING MEMORY UNDER SPECIAL CONDITIONS

L. A. Sivokon' *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 448–449 (See N67-11401 02-04) CFSTI: $8.40

The effect of limited mobility, partial isolation, and noise on the memory process is briefly surveyed. Experimental data obtained from memorizing special texts are listed. R.U.

N67-11647# Joint Publications Research Service, Washington, D. C.

PRINCIPLES OF THE PHYSICAL TRAINING OF ASTRONAUTS

Yu. A. Surinov and G. F. Khlebnikov *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 460–461 (See N67-11401 02-04) CFSTI: $8.40

To increase their resistance to unfavorable space flight conditions, the physical training of astronauts was evaluated. Various forms of general and special activities are enumerated, and the three-stage training is reviewed. A conclusion reported is that the present system of training has prepared astronauts physically for flights up to 5 days. R.U.

N67-11649# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF MUTUAL COMPENSATION OF CERTAIN QUALITIES OF MOTOR ACTIVITY IN PERFORMING COMPLEX COORDINATED MOVEMENT

N. V. Sysoyev *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 464–465 (See N67-11401 02-04) CFSTI: $8.40

For training purposes, test series of motor task capabilities of flying personnel are summarized. It is reported that motor skill was formed and fixed more rapidly, reliably, and adequately in persons with better functional abilities for differentiation of the spatial, time, and strength characteristics of movement. The mutual compensation of certain complex movements is mentioned. R.U.

N67-11657# Joint Publications Research Service, Washington, D. C.

FUNCTIONAL SHIFTS IN THE CORTICAL PART OF THE VISUAL ANALYZER UNDER THE INFLUENCE OF FLIGHTS

A. I. Ustinova *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 478–479 (See N67-11401 02-04) CFSTI: $8.40

Fatigue studies on flying personnel were performed by determining their threshold magnitudes to an inadequate stimulus, the critical frequency of phosphene disappearance, and the duration of a visual successive image with its latent period. A portable impulse generator was used to transmit single stimuli of 1–1000 microamperes and rhythmic stimuli of 2–150 cps frequency at a duration of 2 to 50 milliseconds. Results showed that functional shifts in the state of excitability and lability during flight depended upon duration, number of take-offs and landings, and the length of the work day and flight time. Flight personnel displayed a parallel increase of excitability and lability of the visual analyzer after 2–3 and 4–5 hours of continuous flight; physiological reactions after 6–7 hours of continuous space flight were individual in nature and varied in direction. G.G.

N67-11659# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF THE QUANTITATIVE CHARACTERIZATION OF THE FUNCTIONAL STATE OF THE VESTIBULAR ANALYZER OF MAN BY THE METHOD OF ROTARY TESTS

Yu. V. Farber *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 482–483 (See N67-11401 02-04) CFSTI: $8.40

The correlation between sensory reaction and vestibular analyzer stimulation was examined by rotating 50 persons at 15, 30, 60, 90, 120, 150, and 180° per/seconds, respectively. Nystagmus was recorded by electronystagmography. It was found that the duration of the post-rotational reactions was proportional to the logarithm of the magnitude of the stop stimulus: up to 60°/sec for the illusion of counterrotation, up to 90°/sec for nystagmus, and up to 120°/sec for the number of nystagmic movements. A relationship between nystagmus and the illusion of counterrotation with respect to threshold and duration was not established. G.G.

N67-11664# Joint Publications Research Service, Washington, D. C.

SOME INDICES OF THE ACTIVITY OF AN OPERATOR IN THE PROCESS OF TRACKING

G. V. Khlyustikov and S. D. Khoruzhaya *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 492 (See N67-11401 02-04) CFSTI: $8.40

Experiments on tracking performance, based on error compensation, are briefly reviewed. It was found that the quality of tracking depended on the characteristics of both the input signal and the regulated object. N.E.N.

N67-11693*# Sandia Corp., Albuquerque, N. Mex.

DEVELOPMENT OF AN INCREASED SAMPLING RATE MONITORING SYSTEM

W. J. Whitfield and J. C. Mashburn Oct. 1966 9 p

(NASA Order R-09-019-040)

(NASA-CR-79537; SC-RR-66-585) CFSTI: HC $1.00/MF $0.50 CSCL 06B

This report briefly describes a developmental device that samples air for small particles in clean rooms. It differs from standard monitors in that it samples at an increased rate and is designed for very low concentrations of airborne particles. Test results, indicate that this device is superior to present particle counters. Author

N67-11695* Kansas State Univ., Manhattan.

FURTHER EVIDENCE ON SECONDARY TASK INTERFERENCE IN TRACKING

Merrill Noble, Don Trumbo, and Frank Fowler [1966] 13 p refs Submitted for Publication

(Grant NsG-606)

(NASA-CR-79622) CFSTI: HC $1.00/MF $0.50 CSCL 05I

Two experiments indicate that (1) presence of a second task throughout training in pursuit tracking resulted in a learning as well as a performance decrement at either transfer or retention tests, (2) the locus of the interference appears to be in the selection of an overt response for the second task, since a covert response condition did not lead to a decrement in either task, nor, when divested of any response selection requirement, did an overt response condition interfere with tracking performance. Author

N67-11834# Federal Aviation Agency, Washington, D. C. Office of Aviation Medicine.

INJURY POTENTIALS OF LIGHT-AIRCRAFT INSTRUMENT PANELS

John J. Swearingen Apr. 1966 5 p refs

(AM-66-12)

Results of head-impact tests against typical light-aircraft instrument panels to determine their g time–force parameters during deformation of structure are presented for three different velocities of impact. Evaluations of the energy attenuator recently added by one aircraft company to its aircraft instrument panel as well as other nonprotected panels are presented. Injury potentials of these impacts are determined based on recently established data of tolerances of the living human head to impact. According to this study, head impacts as low as 15 ft/sec against the rigid angular instrument panels studded with heavy instruments certainly would be fatal. The light cylinder of aluminum added by the one company will give adequate protection to head impacts up to 25 ft/sec. Protection could be afforded up to 40 ft/sec head impacts, however, by increasing the strength of the aluminum cylinder at a sacrifice in higher but not injurious head-impact loads. Author

N67-11835# Federal Aviation Agency, Washington, D. C. Office of Aviation Medicine.
PERFORMANCE TASKS FOR OPERATOR-SKILLS RESEARCH
Richard G. Pearson Jun. 1966 16 p refs
(AM-66-19)

The selection, development, and operation of several tasks for use in skilled operator performance research are described. The tasks are intended, collectively, to sample a broad spectrum of abilities required by complex operator systems; individually they vary to the extent with which demands are placed upon attentional, sensory input, decision, and motor processes. A tracking and monitoring task simulates some of the functions associated with pilot skill, while a radar ATC task simulates the en route controller's functions. Other tasks (auditory vigilance, problem solving, mental arithmetic, and choice reaction time) are of a more abstract nature. Author

N67-11847*# Kansas State Univ., Manhattan.
SEQUENTIAL PROBABILITIES AND THE LEARNING AND RETENTION OF TRACKING SKILL
Jane Quigley, Don Trumbo, and Merrill Noble [1966] 14 p Presented at the Midwestern Psychol. Assoc. Meeting, Chicago, 6 May 1966
(Grant NsG-606)
(NASA-CR-79915) CFSTI: HC $1.00/MF $0.50 CSCL 05I

Investigations were undertaken to determine whether task predictability, defined alternatively in terms of second-order probabilities among target events, would affect tracking performances in a similar way. Also considered were the response strategies which subjects developed to cope with varying degrees of uncertainty in a sequential tracking task. Subjects were randomly assigned to six experimental conditions; the principal performance measure was integrated absolute error obtained electronically by integrating the voltage differential between target and cursor inputs. The results show that the sequential probabilities appear to degrade overall tracking performance disproportionately to the amount of uncertainty they introduce; however, subjects apparently learn to cope with the uncertainties in a coherent, if not optimal, manner. The strategy which is developed seems rather complex, including differential decision times consistent with the amount of uncertainty involved, probability matching when the choices are dichotomous, and compromise-matching when the choice is continuous. M.G.J.

N67-11849*# Kansas State Univ., Manhattan.
THE ORGANIZATION OF SKILLED RESPONSE
Merrill Noble and Don Trumbo [1966] 42 p refs Submitted for Publication
(Grants NsG-606; AF-AFOSR-62-17)
(NASA-CR-79919) CFSTI: HC $2.00/MF $0.50 CSCL 05I

A series of experiments concerned with the ways in which responses become organized is discussed. The principle parameter in most studies was stimulus coherence, and tracking tasks were used as a vehicle because graded responses permit detailed and fine-grained analyses. Both spatial and temporal coherence are used in response organization, and type of response strategy varies with degree of stimulus coherence. The effects of secondary tasks, sequence length, and task coding were also examined. Author

N67-11850*# Kansas State Univ., Manhattan.
ON THE LENGTH–DIFFICULTY RELATION IN SKILL PERFORMANCE
Jay Swink, Don Trumbo, and Merrill Noble [1966] 18 p refs Submitted for Publication
(Grant NsG-606)
(NASA-CR-79920) CFSTI: HC $1.00/MF $0.50 CSCL 05I

Sequence length in an irregular step function tracking task was varied in order to evaluate the effect on acquisition and retention of a motor skill. A 5×2×2×2 factorial design was used with 5 sequence lengths, 2 degrees of task coherence, 2 training criteria (equal practice *vs* equal repetitions), and 2 long-term retention intervals. The results support Deese's contention, based on verbal serial learning, that repetitions *per item* do not increase with length of the series, although total learning time and total number of repetitions do increase approximately as suggested by Thurstone's exponential equation. Author

N67-11900# Illinois Univ., Urbana. Training Research Lab.
PROJECT SOCRATES: A FLEXIBLE RESEARCH FACILITY TO BE USED IN STUDIES OF PRE-PROGRAMMED SELF-INSTRUCTION (PSI) AND SELF-PROGRAMED INDIVIDUALIZED EDUCATION (SPIE) Final Report
Lawrence M. Stolurow Sep. 1966 31 p refs
(Contract Nonr-3985(04))
(AD-638676) CFSTI: HC $2.00/MF $0.50

This is the final report of work accomplished on Project SOCRATES (System for Organizing Content to Review and Teach Educational Subjects). The Project contributed to the development and operation of a computer-based facility for psychological research on variables associated with pre-programed self-instruction (PSI) and self-programed indivualized education (SPIE). The research was concerned with the development of psychological theory and research relating to the design and use of a computer-based instructional system. Author (TAB)

N67-11921# California Univ., Los Angeles. Western Management Science Inst.
COMPUTER SCIENCE DEVELOPMENTS RELEVANT TO PSYCHOLOGY
Earl B. Hunt Aug. 1966 37 p refs Presented to Div. 3 (Experimental Psych.), Am. Psych. Assoc., New York, Sep. 1966 *Its* Working Paper No. 104
(Contract Nonr-233(75))
(AD-638853) CFSTI: HC $2.00/MF $0.50

The application of computers in Psychology can be divided into three broad areas: mathematical computation, file manipulation, and on-line control of experimentation. New languages and better computing techniques will make the first area of application much easier. On-line consoles permitting rapid access to the computer will largely replace the present day desk calculators used in many psychological data processing problems. The use of electronically stored files will make record searching and screening much easier. The most interesting new applications, however, will be in the area of on-line control of experiments by man-machine interaction. The developments in computer science which make these applications possible are discussed in some detail. In addition, there are conceptual developments in computer science, particularly in the study of artificial intelligence, which may provide leads in the development of psychological theory. Author (TAB)

N67-12033# Federal Aviation Agency, Oklahoma City, Okla.
A TABLE OF INTENSITY INCREMENTS
Jerry V. Tobias Jan. 1966 5 p
(AM-66-4)

Small intensity increments can be produced by adding larger intensity increments. A table is presented covering the range of small intensity increments from 0.008682 through 6.020 dB in 60 large intensity increments of 1 dB. Author

N67-12067*# Denver Univ., Colo.
SHORT PERIOD FLUCTUATIONS IN INTELLIGENCE Final Report
Sep. 1966 57 p refs
(Grant NsG-518)
(NASA-CR-79740) CFSTI: HC $3.00/MF $0.50 CSCL 05J

The problem of isolating fluctuations in the intellectual function was investigated by measuring 14 primary mental abilities of 106 male adults on 10 separate occasions. The existing evidence indicating that measures of intelligence are stable and that intelligence is a highly stable attribute of man is reviewed. A method of analysis is described which identifies patterns representing stable differences between individuals (traits) and patterns representing between-person differences that are reliably observed on each of several occasions but which are not stable from one occasion to another (states). Test results indicated that fluid intelligence (as well as other attributes of intellectual test behavior) varies functionally within persons and also represents a stable pattern of performances that distinguishes one person from another. L.E.W.

N67-12080*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
AN ASYNCHRONOUS PULSE-AMPLITUDE PULSE-WIDTH MODEL OF THE HUMAN OPERATOR
M. J. Merritt Mar. 1966 42 p refs
(Grant NGR-05-018-022)
(NASA-CR-79760; USCEE-128) CFSTI: HC $2.00/MF $0.50 CSCL 06D

Details are given on the development of a human operator model which produces discrete pulse outputs in response to continuously presented Gaussian random inputs. The parameters of the model were identified from experimental data taken from a subject in an advanced state of training. Computer procedures for the complete identification of all model parameters are described. Results indicate: (1) The human operator reaction time of 200 milliseconds is in excellent agreement with other data. (2) Pulse amplitude and pulse width models for negative pulses produce better correlations with experimental data than for positive pulses. (3) Pulse amplitude models for positive and negative pulses are similar, despite considerable asymmetry in pulse amplitude distributions. (4) Human operators use pre-programmed pulse sequences. However, it is pointed out that it is not feasible to determine whether the model errors observed are random or functionally dependent on the human operator inputs and input–output history. M.G.J.

N67-12128*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GAS CHROMATOGRAPHY COLUMN DEVELOPMENT FOR ANALYSIS OF THE MARTIAN ATMOSPHERE
W. F. Wilhite *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 119–123 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

By using a recently-developed porous polymer bead column packing material, resolution of nearly all the components of interest in the Martian atmosphere can be obtained with one gas chromatographic column for a period of less than 15 min. Development of the combined gas chromatograph-mass spectrometer experiment to separate atmospheric constituents is discussed, and the various constituents that require identification are listed. The poor baseline stability that resulted from the use of temperature programming during the separation of N and CO is noted; and the excellent stability obtained through the use of better flow control and a 50–80 mesh Porapak Q is reported. Further improvements permitted the resolution of all components of interest except oxygen, argon, and carbon monoxide which can easily be determined by mass spectrometry. The peak shape for all the components is excellent, except for ammonia and nitrogen dioxide which tail. M.W.R.

N67-12177*# Naval School of Aviation Medicine, Pensacola, Fla.
ORIENTATION IN AEROSPACE FLIGHT
Ashton Graybiel 10 Oct. 1966 45 p refs Presented at 15th Intern. Congr. on Aviation and Space Med., Prague, 30 Sep. 1966 *Its* Spec. Rept.-66-6 Joint rept. with NASA
(NASA Order R-93)
(NASA-CR-80123) CFSTI: HC $2.00/MF $0.50 CSCL 05H

Attention is focused on some of the problems involved in spatial orientation which have been experimentally examined. Emphasis is placed on a consideration of the evolutionary manner in which orientational homeostasis is acquired under terrestrial conditions. Examples are given of interactions between cues from visual and force environments and the influence of nonvisual cues on the visually perceived direction of space. Weightlessness effects on the otilith organs are discussed, and reports of introspective observations by astronauts and cosmonauts from their experiences in weightless environments are included. A.G.O.

N67-12185# Naval Personnel Research Activity, San Diego, Calif.
PROMPTING VS FEEDBACK IN TRAINING AUDITORY JUDGMENTS OF VARYING DIFFICULTY
E. G. Aiken Aug. 1966 17 p refs
(STB-67-5; AD-639225) CFSTI: HC $1.00/MF $0.50

Two training procedures were compared for their efficiency in training two auditory judgments. One procedure (prompting) involved presentation of the correct answer before the presentation of the stimulus. The other procedure (feedback) involved presentation of the correct answer after the subjects had judged the stimulus. Results indicate: (1) A substantial trend toward superiority of feedback in improving pitch discrimination performance at two levels of difficulty, (2) a trend toward superiority of prompting in the training of pitch and intensity identification, (3) a substantial trend toward greater transfer to a Doppler discrimination problem following auditory identification as opposed to auditory discrimination training. Recommendations are made concerning implications of the data for Navy training and future research. Author (TAB)

N67-12233*# Texas Univ., Austin. Defense Research Lab.
STIMULUS-ORIENTED APPROACH TO DETECTION RE-EXAMINED
Lloyd A. Jeffress 6 Sep. 1966 37 p refs Prepared for Navy
(NASA Order R-129; Contracts NObsr-93124; Nonr-3579(04))
(NASA-CR-78973) CFSTI: HC $2.00/MF $0.50 CSCL 05H

Motivated by some new insights resulting from attempts to replicate experiments with human observers through the use of an electrical model of the auditory system, the effect of signal duration on detection in the presence of a continuous masking noise is considered. The model, of those tried, that best fits human performance consisted of a bandpass filter obtained by subtracting the output of a 500 Hz sharp-cutoff, low-pass filter from another having a cutoff of 525 Hz. The filter was followed by a linear half-wave rectifier, and it in turn by an integrator having a 100 msec time. The integrator can be thought of as a device which takes a running average of its input. The probability density distributions for N and SN yielded by the model lie between the Rayleigh–Rice distributions on the one hand and a pair of normal distributions of unequal variance on the other. The exact shape of the two distributions depends upon both the bandwidth of the filter employed and the time constant of the averager. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N67-11273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH MOLECULAR COMPOUNDS Selected Articles

31 May 1966 56 p refs Transl. into ENGLISH from Vysokomol. Soedineniya (USSR), v. 6, no. 10, 1964 p 1755–1757, 1802–1805, 1814–1820, 1838–1843, 1852–1861 (FTD-TT-65-757; TT-66-62246; AD-638975) CFSTI: HC $3.00/MF $0.50

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N67-11274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONJUGATED DOUBLE-BOND POLYMERS CONTAINING PYRIDINE RINGS

V. V. Pen'kovskiy *In its* High Mol. Compds. 31 May 1966 p 1–6 refs (See N67-11273 02-06) CFSTI: HC $3.00/MF $0.50

Synthetic ologomers in whose molecules pyridine rings alternated with vinylene groups were obtained by polycondensation of 2,6-lutidine with aromatic dialdehydes in the presence of zinc chloride. The new polymer was a crystalline powder of black color and soluble in dimethyl formamide, phenol, quinoline, benzyl alcohol, concentrated mineral acids, and formic acid. Infrared spectra of the polymer revealed absorption bands at about 800 cm^{-1}, and a strong absorption band at 1600–1620 cm^{-1}. The most probable formula for the obtained polymer displayed an electron resonance singlet and possessed enhanced electrical conductivity. G.G.

N67-11275# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF THE CONDUCTIVITY OF POLYMER FILMS AT HIGH FREQUENCIES

L. I. Boguslavskiy and L. S. Stil'bans *In its* High Mol. Compds. 31 May 1966 p 7–13 refs (See N67-11273 02-06) CFSTI: HC $3.00/MF $0.50

The resistance and activation energy of conductance of films of the polymeric complex tetracyanoethylene (TCE) diminish with increasing frequency. Analysis of the curves depicting the dependence of the conductance on the frequency and a comparison of the activation energies of conductance as determined with the use of direct current and at high frequencies have led to the conclusion that in treating conductance processes in polymeric organic materials account must be made of the barriers between the macromolecules. Author

N67-11276# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POLYMERIZATION OF QUINOLINE COMPLEXED WITH ZINC CHLORIDE

T. A. Topchiyev, V. A. Kabanov, and V. A. Kargin *In its* High Mol. Compds. 31 May 1966 p 15–22 refs (See N67-11273 02-06) CFSTI: HC $3.00/MF $0.50

It has been shown that quinoline complexated with zinc chloride can be polymerized with opening of the nitrogen containing ring and the formation of a conjugated bond polymer. The reaction is initiated by proton-containing substances. The yield of the polymer with time tends to limits depending on the temperature, which is probably the result of establishment of polymerization-depolymerization equilibrium in the system. The polymerization of quinoline has been shown to be of an autocatalytic nature, being accelerated by seedings of previously prepared polyquinoline. The intrinsic viscosity of the polymer increases with increase in the polymerization time, and polymerization for a given time, with increase in initial concentration of initiator. Concurrently there is a rise in concentration of unpaired spins of the resultant polyquinolines. Author

N67-11277# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME ASPECTS OF THE POLYMERIZATION OF 4-CHLOROPYRIDINE

A. A. Berlin, Ye. F. Razvodovskiy, and G. V. Korolev *In its* High Mol. Compds. 31 May 1966 p 23–32 refs (See N67-11273 02-06) CFSTI: HC $3.00/MF $0.50

A preliminary study of the polymerization kinetics of 4-chloropyridine has been made using the thermometric method. Crystal hydrates of Al, Fe and Sn salts as well as 1,4-dibromobutane catalyze the reaction. Pyridine and water considerably retard it, leading to the conclusion that chain growth occurs through the chlorine atom. The temperature dependence of the polymerization has been examined and a possible mechanism of chain termination has been suggested. Based on the kinetic data, it has been inferred that the polymer has a catalytic effect on the course of the polymerization and a possible mechanism of the catalytic action has been proposed. Author

N67-11278# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

KINETICS AND MECHANISMS OF THE POLYMERIZATION OF AROMATIC HETEROCYCLIC COMPOUNDS

V. A. Kabanov, V. A. Kargin, V. P. Kovaleva, and D. A. Topchiyev *In its* High Mol. Compds. 31 May 1966 p 33–48 refs (See N67-11273 02-06) CFSTI: HC $3.00/MF $0.50

A kinetic scheme for autocatalytic polymerization has been proposed in which account is made of the reversibility of the chain growth reaction. Kinetic equations have been derived for the basic parameters of the polymerization of pyridine and quinoline in stoichiometric complexes with zinc chloride, occurring with ring cleavage. A mechanism of the polymerization has been suggested and a discussion has been made of the role of the complexating agents in these reactions. The complexating agent, binding the unshared electron pair of the nitrogen atom enhances the polarization of the nitrogen–carbon bond in the ring and facilitates the heterolytic cleavage of the latter by a proton with the formation of a conjugated bond carbonium cation. Chain formation occurs as the result of the successive addition of a monomer molecule to the active cation. The elementary act of chain growth involves the heterolytic cleavage of the aromatic heteroring. Author

N67-11297# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE PRODUCTION OF ATOMIC OXYGEN BY THE THERMAL DECOMPOSITION OF OZONE

John R. Kelso Jun. 1966 23 p refs (BRL-R-1323; AD-638814) CFSTI: HC $1.00/MF $0.50

To study the reactions of atomic oxygen it is desirable to have a supply that is free of metastable energetic species of molecular and atomic oxygen which are formed in discharged oxygen and because of their side reactions can lead to serious errors in calculations. Therefore, the homogeneous, thermal, gas phase decomposition of dry ozone was tried and found to be a satisfactory source if the residence time of ozone in the furnace is carefully regulated by furnace length and carrier gas flow, followed by rapid cooling of the products of decomposition. Author (TAB)

N67-11304# Little (Arthur D.), Inc., Cambridge, Mass.
INTERFACIAL WATER STRUCTURE: THE ELECTRICAL CONDUCTIVITY OF AQUEOUS ELECTROLYTE PERMEATED PARTICULATE SOLIDS UNDER HYDROSTATIC PRESSURE
R. A. Horne, A. F. Day, R. P. Young, and N. T. Yu 30 Sep. 1966 32 p refs
(Contract Nonr-4424(00))
(TR-23; AD-639218) CFSTI: HC$2.00/MF$0.50

Comparison of the temperature and pressure dependencies of the relative electrical conductivity of aqueous 0.10M KCl solutions and particulate solids permeated with these solutions shows that the water near an interface is structured and that this structured region tends to exclude electrolyte thereby increasing the concentration of the solution at some greater distance from the interface - a conclusion confirmed by simple elution experiments. This water structure near interfaces is more stable with respect to both temperature and pressure and thus presumably different from the structure in bulk liquid water. Two water structural forms are proposed: the one forms the substance of the Frank-Wen clusters, the hydration atmospheres of ions, and polar groups; the second forms the substance of water structure near interfaces, the hydration atmosphere of hydrophobic groups and materials including the quaternary amine ions, and the hydration crust of the hydrophobic segments of biopolymers. Author (TAB)

N67-11306# Little (Arthur D.), Inc., Cambridge, Mass.
THE TOTAL SOLVATION ATMOSPHERES OF THE ALKALI METAL CATIONS IN AQUEOUS SOLUTION
R. A. Horne and J. D. Birkett 30 Sep. 1966 15 p refs
(Contract Nonr-4424(00))
(TR-24; AD-639219) CFSTI: HC$1.00/MF$0.50

Estimates of the total number of water molecules in the hydration atmospheres of the alkali metal cations based on the cationic isotope effect on conductance, the ratio of the limiting conductances, and the H2O-D2O isotope effect on conductance give values in agreement with the earlier estimate based on the minimum in the concentration dependence of the Arrhenius activation energy of viscous flow. Author (TAB)

N67-11318# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CRYSTAL GROWTH
1 Apr. 1966 24 p refs Transl. into ENGLISH from Rost Kristallov, Akad. Nauk SSSR, Inst. Kristallogr. (Moscow), v. 6, 1964 p 117–121, 162–167
(FTD-MT-65-476; TT-66-62118; AD-637445) CFSTI: HC $1.00/MF$0.50

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1. CRYSTAL GROWING OF SILICON CARBIDE FROM THE GAS PHASE Yu. M. Shashkov and V. V. Rozhdestvenskaya p 1–8 refs (See N67-11319 02-06)
2. CRYSTALLIZATION OF MOLYBDATES OF ALKALI-EARTH METALS IN HYDROTHERMAL CONDITIONS B. N. Litvin, L. N. Dem'yanets, and L. S. Garashina p 10–17 refs (See N67-11320 02-06)

N67-11319# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CRYSTAL GROWING OF SILICON CARBIDE FROM THE GAS PHASE
Yu. M. Shashkov and V. V. Rozhdestvenskaya *In its* Crystal Growth 1 Apr. 1966 p 1–8 refs (See N67-11318 02-06)
CFSTI: HC$1.00/MF$0.50

An attempt was made, during alpha-type crystallization of silicon carbide, to evaluate the degree of supersaturation in its gas phase and to reveal factors determining supersaturation and the rate of growth of these single crystals during sublimation. For the experiments, a vacuum system was developed making it possible to heat the crucible up to 2000°C in a vacuum and up to 2800°C in argon. A static argon atmosphere was used. Schematic drawings of the crystal growth vacuum system, and crucible and packing are shown. Results show that along with supersaturation of the gas phase for the base layer, geometric dimensions of the crucible and packing play the most important role in the crystal growth processes of alpha-type silicon carbide from the gas phase. R.N.A.

N67-11320# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CRYSTALLIZATION OF MOLYBDATES OF ALKALI-EARTH METALS IN HYDROTHERMAL CONDITIONS
B. N. Litvin, L. N. Dem'yanets, and L. S. Garashina *In its* Crystal Growth 1 Apr. 1966 p 10–17 refs (See N67-11318 02-06)

Data are presented on the hydrothermal synthesis of calcium, strontium, and barium molybdate crystals. These compounds were synthesized to clarify the possibility of their formation in hydrothermal conditions in acid and alkali media. Results show that the dissolution, transfer, and crystallization of calcium, strontium, and barium molybdates are possible in alkali aqueous solutions containing from 3 to 15% NaOH at 400° to 500°C when the pressure is from 1400 to 1600 atm. Under these conditions, crystals of $CaMoO_4$, $SrMoO_4$, and $BaMoO_4$ with dimensions of 2, 3 to 4, and 5 mm, respectively, are obtained. Aqueous chloride solutions were the most favorable for crystallization of barium molybdate. In acid aqueous solutions containing 5 to 10% LiCl or NH_4Cl, its crystals reach 5 mm. Crystallization of $SrMoO_4$ under these conditions is weaker and is accompanied by the partial decomposition of strontium molybdate. Recrystallization of powellite in small quantities occurs in aqueous solutions of $CaCl_2$. All molybdate crystals were investigated roentgenographically. Powder diagrams of the artificial molybdates were found to be analogous to those of initial chemical reagents R.N.A.

N67-11331*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MIXING AND REACTION STUDIES OF HYDRAZINE AND NITROGEN TETROXIDE USING PHOTOGRAPHIC AND SPECTRAL TECHNIQUES
Marshall C. Burrows Washington, NASA, 1966 15 p refs Presented at the 5th Aerospace Sci. Meeting, New York, 23–25 Jan. 1967; Sponsored by AIAA
(NASA-TM-X-52244) CFSTI: HC $1.00/MF $0.50 CSCL 07B

Distances required to atomize, mix, and react N_2H_4 and N_2O_4 were experimentally determined for a quadlet injector element at 19 atmospheres and an oxidant-fuel weight ratio of 1.0. Streams of like propellants were diagonally opposite at an impingement angle of 90°. Silhouette photographs showed that atomization of the propellant streams occurred in less than 1 inch, and vaporizing pockets of NO_2 extended downstream for 4 inches or less. Concentration profiles of H_2O were determined from measured radiation and gas temperature and plotted as a function of axial distance. The resulting curves compared favorably with H_2O concentrations calculated for combustion profiles limited by either fuel or oxidant vaporization. Author

N67-11351*# Rocketdyne, Canoga Park, Calif.
PROPERTIES OF NONAQUEOUS ELECTROLYTES First Quarterly Report, 20 Jun.–19 Sep.
Rudolf Keller, James N. Foster, and Jack M. Sullivan 19 Oct. 1966 43 p refs
(Contract NAS3-8521)
(NASA-CR-72106; R-6754-1) CFSTI: HC $2.00/MF $0.50 CSCL 07C

Propylene carbonate, dimethyl formamide, and acetonitrile were purified by distillation and the water content of these solvents was determined by gas chromatography. Solutes were purchased in the highest purity possible. Conductance measurements and solubility determinations were made on some electrolytes containing lithium salts and aluminum chloride. Author

N67-11708# Hanford Atomic Products Operation, Richland, Wash.
RECOVERY OF ALUMINUM NITRATE MONOHYDRATE FROM REDOX ACID WASTE. PART 3: MATHEMATICAL DESCRIPTION
W. L. Godfrey, R. Y. Dean, and J. C. Stouffer Dec. 1965 33 p
(Contract AT(45-1)-1350)
(HW-82771, pt. 3) CFSTI: HC $2.00/MF $0.50

A rigorous mathematical model was developed for the recovery of aluminum nitrate monohydrate from Redox acid waste by crystallization from a concentrated nitric acid solution. A countercurrent crystallization process was developed, which permits multiple states of crystallization without requiring the separation of crystals and supernate following each stage. Bench-scale investigations and analog computer studies of the process were performed previously. The major additional contributions of the rigorous model are considerations of shrinkage and expansion due to temperature changes, the volume occupied by crystals, washover from cell-to-cell of crystals during the backwash, dissolution of crystals by unsaturated backwash stream, and inclusion of contaminants within the crystal or as a tightly adsorbed layer. NSA

N67-11725*# Illinois Univ., Chicago.
METHODS OF FORMATION OF THE NITROSO GROUP AND ITS FORMATIONS
J. H. Boyer [1966] 154 p refs
(Grant NGR-14-012-004)
(NASA-CR-79491) CFSTI: HC $5.00/MF $1.00 CSCL 07C

Extensive data are presented on the chemistry of the C-nitroso compounds. Several preparative methods are discussed, including nitric oxide and radicals; irradiation of nitrosyl halide with alkanes; pyrolysis and photolysis of nitrite esters; oxidative nitrosation; nitrosation of primary, secondary, and tertiary aromatic amines, phenols, aromatic ethers, olefins, and phenols and heterocycles with nitrite esters and alkoxides; nitrosative decarboxylation; organometallic compounds and nitrosyl chloride; geminal nitrosohalides from oximes; esters of geminal nitrosoalcohols from oximes; oxidation of dioximes, hydroxylamines, primary, secondary, and tertiary amines, and nitrones and Schiff bases; reduction and deoxygenation of nitro compounds; Nef reaction; pyrolysis of heterocycles; electrolysis of oxime salts; condensation reactions; nitroso compounds from diazo compounds; and natural occurrence. Structures and reactions are also considered. M.G.J.

N67-11741# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England). Materials Lab.
A METHOD FOR GAS-HYDRIDING ZIRCONIUM ALLOYS AT 400°C
J. Winton 1966 9 p
(TRG-1255(C)) HMSO: 1s 9d

As part of an investigation into the distribution of hydrogen through the walls of zirconium alloy tubes, an experimental method has been developed for gas hydriding. It involves the addition of a low partial pressure of CCl_4 to the furnace atmosphere to disrupt the impermeable oxide skin. Author

N67-11753# India. Dept. of Atomic Energy, Bombay.
INVESTIGATION OF MATERIALS FOR FIXATION OF LOW AND MEDIUM LEVEL RADIOACTIVE WASTE IN STABLE SOLID MEDIA
R. C. Rastogi, J. D. Sehgal, and K. T. Thomas 1966 75 p refs
(Contract IAEA-261/RI/US)
(AEET-250) CFSTI: HC $3.00/MF $0.75

This report describes a proposal for fixation into vitreous matrices of spent vermiculite and synthetic chemical treatment plant sludge obtained as secondary wastes in the treatment of radioactive liquid effluents and ashes obtained by burning contaminated combustible wastes in a pilot incinerator. Results on the fusion studies of the mineral vermiculite, synthetic sludge and incinerator ashes, leaching characteristics of the fused mass, and volume reduction obtainable are presented. An apparatus assembled for studying volatilization losses of cesium, strontium, and ruthenium during firing; a method for evaluating volatilization; loss of cesium by using its stable salt; and an application of flame photometry to estimate volatilized cesium are described. Results on the loss of cesium by volatilization during firing are presented. Effect of self-absorption of radiation during final storage on corrosion resistance of glass has also been studied. Author

N67-11759# India. Dept. of Atomic Energy, Bombay.
EXTRACTION OF TUNGSTEN FROM WOLFRAMITE
T. R. Bhat and Y. W. Gokhale 1966 24 p refs
(AEET-251) CFSTI: HC $1.00/MF $0.50

The extraction of tungsten from wolframite by the carbonate process is described in detail. The influence of various parameters such as the amount of sodium carbonate, sodium chloride, sodium nitrate, temperature and duration of heating on the extent of reaction with the ore was studied. Detailed data are presented on (a) leaching of the reacted mass with water; (b) precipitation of tungstic acid from sodium tungstate solution; (c) influence of the amount and concentration of acid, concentration of tungstate solution, temperature, mode of mixing etc. on the recovery, bulk and packing densities, and particle size of tungstic oxide; (d) settling characteristics of tungstic acid; (e) purification of tungstic acid by dissolution in ammonium hydroxide and subsequent precipitation as ammonium paratungstate; and (f) recovery of tungsten from waste solutions as calcium tungstate and further conversion to tungstic acid by acid treatment. Under the optimum conditions, large scale experiments were carried out in batches of 10 kgs and 25 kgs of ore with an overall tungsten recovery of better than 98%. Author

N67-11826# Joint Publications Research Service, Washington, D. C.
STEREOCHEMISTRY OF ORGANIC COMPOUNDS OF PHOSPHORUS AND ARSENIC
G. Kamay and G. M. Usacheva 8 Nov. 1966 33 p refs Transl. into ENGLISH from Usp. Khim. (USSR), no. 8, 1966 p 1404–1429
(JPRS-38534; TT-66-34959) CFSTI: $1.00

Recent literature on stereochemistry is reviewed. Organic compounds of trivalent phosphorus and arsenic, quaternary phosphonium and arsonium, oxides and sulfides of phosphorus and arsenic, and organophosphorus (arsenic) acids are covered. The isolation and synthesis of the compounds and their optical properties are emphasized as well as their formulas and structure. N.E.N.

N67-11830# Joint Publications Research Service, Washington, D. C.
KINETICS OF THERMOGALVANIC CORROSION AND THE CALCULATION OF THE PARAMETERS OF THERMOGALVANIC COUPLES
A. Ya. Shatalov, S. A. Kaluzhina, and I. K. Marshakov 15 Nov. 1966 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), no. 6, 1965 p 931–935
(JPRS-38648; TT-66-35073) CFSTI: $1.00

An expression was developed for the value of the thermogalvanic current based on electrochemical kinetics, and experiments to verify the equation are described. It was assumed that the only process of anode direction on the hot and cold electrodes is the ionization of the metal, and that the cathode process consists of hydrogen ions in the discharge or in the precipitation of identical metal ions from the solution. The experiments investigated the effects of the temperature difference between the electrodes, the galvanic corrosion of various metals, and the degree of localization of corrosion losses when the couples are short circuited. It was established that as the temperature difference becomes greater the localization of the corrosion losses on the anode increases in normal couples, and decreases in reversed couples. N.E.N.

N67-11838# Bureau of Mines, Tuscaloosa, Ala. Metallurgy Research Center.

LABORATORY PROCESSES FOR WASHING TETRABROMOETHANE FROM MINERAL PARTICLES

James S. Browning, R. B. Tippin, and Thomas L. Mc Vay 1966 14 p refs

(BM-RI-6729)

Research demonstrated that organic heavy liquid adhering to or adsorbed on fine mineral particles can be effectively removed by a method embracing pulping or dislacement washing with hot water alone or in combination with a detergent. Displacement washing with steam alone or in combination with a detergent also was effective for removing the heavy liquid. In tests of sized minus 48- plus 200-mesh mineral charges, both the hot water washing with detergents and detergent steaming effectively reduced the heavy liquid losses on the particles to about 0.2 pound per ton of mineral or less. Centrifuging of the wash solutions permitted an almost complete recovery of heavy liquid from the solution as a pure heavy liquid product. Author

N67-11840# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

SEPARATION OF HF FROM HF–SiF_4–H_2O MIXTURES

Robert K. Koch, Arden D. Fugate, and Henry E. Blake, Jr. 1966 19 p refs

(BM-RI-6877)

Separating HF from HF–SiF_4–H_2O mixtures was investigated by passing the mixed gases through a sodium fluoride slurry in an airlift scrubber and forming a mixed precipitate of $NaHF_2$ and Na_2SiF_6. The oven-dried precipitate was thermally dissociated in two stages. The first stage was carried out at 400°C and dissociated $NaHF_2$ to NaF and HF. Condensation and analysis of the evolved HF proved it to be 97 to 99 weight-percent HF containing 0.79 to 0.99 weight-percent H_2O and 10 to 93 ppm silicon. The second stage was carried out at 700°C and dissociated Na_2SiF_6 to NaF (for recycle) and SiF_4. The quantity of HF recovered from gaseous HF–H_2O–air mixtures decreased with increasing relative H_2O concentrations. Air was beneficial when scrubbing extremely dilute wet HF gases. At HF partial pressures of 0.24 and 0.013 mm Hg in the scrubber entrance gases, HF partial pressures of 8.2×10^{-4} and 9×10^{-5} mm Hg were obtained, respectively, in the scrubber exit gases. Scrubber efficiencies were 99.7 and 99.3 percent. Author

N67-11844*# Dudley Observatory, Albany, N. Y.

THE SURVIVAL OF MICROORGANISMS IN SPACE. FURTHER ROCKET AND BALLOON BORNE EXPOSURE EXPERIMENTS

John Hotchin, Peter Lorenz, Aletha Markusen, and Curtis Hemenway [1966] 7 p Presented at the COSPAR Meeting, Vienna, May 1966

(Grant NsG-155)

(NASA-CR-79911) CFSTI: HC $1.00/MF $0.50 CSCL 06M

In survival studies on the exposure of terrestrial microorganisms to the space environment, the organisms used were coliphage T_1, penicillium roqueforti (THOM) mold spores, polio virus type I, and bacillus subtilis spores. Results show: (1) A human pathogen polio virus type 1 can survive at an altitude of 35 km for long periods, and at altitudes up to 150 km for brief periods. (2) Little or no loss of viability could be detected in bacterial or mold spores after exposure at altitudes up to 150 km for about 3 minutes. (3) Inactivation of highly dispersed coliphage T_1 was rapid at 150 km, but highly aggregated T_1 phage showed a surviving fraction of 10^{-4} after about 3 minutes. It is pointed out that solar radiation appears to be the primary cause of inactivation of microorganisms in space, and that thin layers of appropriate filtering material can offer enormous protection. M.G.J.

N67-11864# Aktiebolaget Atomenergi, Stockholm (Sweden).

NEUTRON-ACTIVATION ANALYSIS OF BIOLOGICAL MATERIAL WITH HIGH RADIATION LEVELS

K. Samsahl Sep. 1966 16 p refs

(AE-247) CFSTI: HC $1.00/MF $0.50

A method has been developed for the chemical separation and subsequent gamma-spectrometric analysis of the alkali metals, the alkaline earths, the rare earths, chromium, hafnium, lanthanum, manganese, phosphorus, scandium, and silver in neutron-activated biological material. The separation steps, being fully automatic, are based on a combination of ion-exchange and partition chromatography and require 40 min. Author

N67-11881# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANODIC POLARIZATION BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS IN SULFURIC ACID SOLUTIONS

James M. Peters (M.S. Thesis) Jun. 1966 56 p refs

(GAM/MC-66B-5; AD-639419) CFSTI: HC $3.00/MF $0.50

The study was made to investigate the anodic polarization behavior of commercially-available titanium alloys in sulfuric acid solutions. Six materials were investigated at 22 plus or minus 1C using the potentiostatic technique. The electrolyte was 1, 5, and 10 normal concentrations of hydrogen-saturated, sulfuric acid. Anodic polarization curves (potential versus log current density) were obtained for all specimens in each of the three acid solutions. In addition, corrosion potential runs were determined for a 0.1N H2SO4 solution. All specimens display an active-to-passive transition. The alloy containing 13V-11Cr-3Al was the only specimen investigated which exhibited transpassive behavior in the normal range of interest (E sub corr to +3.0 volts). None of the specimens exhibited Tafel behavior for anodic dissolution in the active region or in the transpassive region. The passive current density, ip, was less than 20 microamps/sq cm for all specimens, indicating the presence of a stable passive film on the specimen surface. The magnitude of the passive current density, ip, did not vary significantly with acid concentration. The passivation potential, Ep, became more noble (positive) with increasing acid concentration. The magnitude of the critical current density, icr, increased with increasing acid concentration. The corrosion potential was essentially constant for the 1, 5, and 10 normal environments. It was more noble by 0.2 to 0.4 volts in 0.1N acid concentrations for all specimens except the Ti-8Al-1Mo-1V alloy, for which it is more noble by almost 0.7 volts. (Author) TAB

N67-11907# European Atomic Energy Community, Brussels (Belgium).

DETERMINATION OF OXYGEN TRACES IN LEAD [DETERMINAZIONE DI TRACCE DI OSSIGENO NEL PIOMBO]

G. Semini and W. Leyendecker Aug. 1966 14 p refs In FRENCH; ENGLISH summary

(EUR-3072.i) CFSTI: HC $1.00/MF $0.50

Trace determination of oxygen in lead is described. Oxygen, after reduction by hydrogen at 700°C, is transformed in water-steam, which is quantitatively absorbed and titrated. The detection limit is 0.6 ppm oxygen. The coefficient of variation of the method is less than 15% at levels between 1.5 and 32 ppm oxygen. Amounts of PbO are found quantitatively, and three to four determinations a day are possible with this technique. Author

N67-11908# European Atomic Energy Community, Brussels (Belgium).
DETERMINATION OF BORON TRACES IN THE MATERIALS USED IN THE ORGEL REACTORS: URANIUM MONOCARBIDE, SAP, TERPHENYL [DETERMINAZIONE DI TRACCE DI BORO NEI MATERIALI UTILIZZATI NELLA FILIERA ORGEL:
G. Serrini and W. Wehking Aug. 1966 25 p refs In FRENCH; ENGLISH summary
(EUR-3073.i) CFSTI: HC $1.00/MF $0.50

Trace determination of boron in uranium monocarbide, SAP materials and terphenyls by chemical ways is described. The detection limit obtained is 0.05 ppm for uranium monocarbide and terphenyls, 1.2 ppm for SAP materials. The coefficient of variation of the method is 5% at level of 0.2 ppm boron in uranium monocarbide and 1 ppm boron in SAP materials, and 20% at level of 0.1 ppm boron in terphenyls. The results obtained are in agreement with those found by other analytical techniques. Author

N67-11931# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ANODIC POLARIZATION BEHAVIOR OF COBALT-CHROMIUM ALLOYS IN SULFURIC ACID SOLUTIONS
George Taylor Seaman (M.S. Thesis) Jun. 1966 65 p refs
(GAM/MC-66B-8; AD-639420) CFSTI: HC $3.00/MF $0.75

The anodic polarization behavior of annealed cobalt-chromium alloys in hydrogen saturated sulfuric acid solutions was investigated by using a potentiostatic technique. Polarization curves were obtained for eleven specimens, ranging from 100% cobalt to 100% chromium, in one normal, five normal, and ten normal sulfuric acid solutions at room temperature. The polarization curves for all specimens, except pure cobalt and the 95Co-5Cr alloy, exhibited active, passive, and transpassive behavior. Cathodic currents or loops were found in the passive region for all of the five specimens containing more than 30% chromium. Only the secondary active region was obtainable for five of the polarization curves, causing variation in the general trend of the polarization data. Increasing the acid concentration had the overall effect of shifting the polarization curves for each specimen in the noble direction. The general effect of increasing the chromium content was to shift the active region in the active direction without changing the transpassive region potential. Tafel behavior was observed in the transpassive region for all specimens containing more than 5% chromium. The Tafel slope varied from 0.168-0.239 for the high cobalt alloys to 0.038-0.048 for the high chromium alloys. As the chromium content of the specimens increased, the corrosion potential slowly became more active, except with six specimen-solution combinations where only secondary corrosion potentials were measurable. In all but two cases, the corrosion potential became more noble with an increase in pH. Author (TAB)

N67-11935# Picatinny Arsenal, Dover, N. J.
MOLECULAR SPECTROSCOPY WITH LOW ENERGY NEUTRONS (I)
Henri Boutin, Samuel Trevino, and Henry Prask Sep. 1966 61 p refs
(PA-TR-3370; AD-639208) CFSTI: HC $3.00/MF $0.75

The information contained in the neutron inelastic scattering spectra of powder or polycrystalline samples obtained by the slow chopper time-of-flight technique is a useful complement of Raman and infrared measurements. In the latter case, a number of symmetry-dependent selection rules govern the interaction and determine the various frequencies observable in the spectra. In the case of incoherent neutron scattering, such selection rules do not apply so that all energy transfers between neutrons and lattice vibrations or rotational and vibrational motions of individual molecules are observed. The technique of 'cold' neutron scattering was applied to the study of several organic molecules. The results of these studies are represented and compared with Raman and infrared measurements. TAB

N67-11981# California Univ., Berkeley. Lawrence Radiation Lab.
IMPROVED CORRELATION FOR THE HEATS OF FORMATION OF INORGANIC COMPOUNDS
Waseem Brelvi (M. S. Thesis) 16 May 1966 92 p refs
(Contract W-7405-ENG-48)
(UCRL-16865) CFSTI: HC $3.00/MF $0.75

An existing equation for estimating the standard heat of formation of solid inorganic compounds was improved. The original equation was derived from Linus Pauling's electronegativity scale. The present form of the equation involves four characteristic parameters for each valence state of an ion present in a compound. The parameters for any ion may be correctly evaluated if experimental heats of formation of at least four of its compounds are known. The equation was used to correlate the known heats of formation of a large number of solid inorganic and simple metallic organic compounds. Typical compounds are metallic halides, oxides, sulfides, sulfates, silicates, tungstates, molybdates, etc. The average deviation from experimental values in correlating the heats for 611 compounds was 2.08 kcal/M. Heats of formation predicted by the correlation were estimated to be reliable to ±13 kcal/M. Calculations based on the correlation led to a method of investigating any suspected errors in experimental data. Based on these calculations, it appears that the experimental heats of formation of Al_2S_3, $La(OH)_3$, and $FeCrO_4$ are seriously in error. Author (NSA)

N67-11983*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION REPORT ON THE NEPHELOMETRIC METHOD OF NONVOLATILE RESIDUE (NVR) ANALYSIS
A. C. Krupnick and W. M. Zittle 19 Sep. 1966 31 p
(NASA-TM-X-53520) CFSTI: HC $2.00/MF $0.50 CSCL 07C

A statistical treatment of a nephelometric instrumental technique and a gravimetric technique of analyzing the level of nonvolatile residue (NVR) in hydrocarbon cleaning solvents used for cleaning launch vehicle and spacecraft component surfaces, was made. The limit of error and operator bias for both techniques are described. A discrete analysis by the nephelometer requires only 45 secs as opposed to 2-1/2 hrs by the gravimetric technique. The data comparison also indicates that the nephelometric method is more accurate, has greater reproducibility, and offers considerable reduction in operator error. The instrument can be operated both in the relative and absolute modes, and can analyze either batch or continuous type samplings. L.S.

N67-12002# Joint Publications Research Service, Washington, D. C.
TRANSESTERIFICATION OF PHOSPHITES AND PHOSPHINITES BY MONOHYDRIC AND POLYHYDRIC ALCOHOLS AND PHENOLS
K. A. Petrov and R. G. Gol'tsova 8 Nov. 1966 24 p refs Transl. into ENGLISH from Usp. Khim. (USSR), no. 8, 1966 p 1477-1494
(JPRS-38535; TT-66-34860) CFSTI: $1.00

Structural formulas showing the transesterification reactions of neutral and acid phosphites and phosphinites with monohydric

and polyhydric alcohols and phenols are presented. The reactions are discussed with respect to reacting conditions, concentration of reagents, equilibrium, stability of products formed, mechanism of reaction, and yields. L.S.

N67-12039# Bureau of Mines, Berkeley, Calif.
HEATS OF FORMATION OF LITHIUM SULFATE AND FIVE POTASSIUM- AND LITHIUM-ALUMINUM SILICATES
R. Barany and L. H. Adami 1966 22 p refs
(BM-RI-6873)

The heats of formation of seven substances were determined by solution calorimetry. At 298.15°K, the heat of formation of lithium sulfate from lithium, rhombic sulfur, and oxygen was −343.1±0.7 kcal/mole, and the heat of formation of lithium sulfate monohydrate from lithium, rhombic sulfur, oxygen, and hydrogen was −414.3±0.7 kcal/mole. For the silicates, the heats of formation at 298.15°K from the elements were kaliophilite, −503.8±0.5 kcal/mole; leucite, −721.6±0.8 kcal/mole; eucryptite, −505.2±0.6 kcal/mole; alpha-spodumene, −727.9±0.9 kcal/mole; and beta-spodumene, −721.1±0.9 kcal/mole. The corresponding heats of formation at 298.15°K from the constituent oxides were kaliophilite, −42.7±1.1 kcal/mole; leucite, −42.8±1.1 kcal/mole; eucryptite, −16.1±0.7 kcal/mole; alpha-spodumene, −21.0±0.7 kcal/mole; and beta-spodumene, −14.3±0.7 kcal/mole. Author

N67-12061# New York Univ. N. Y. Dept. of Chemistry.
RELAXATION ELECTRODE PROCESSES WITHOUT A PRIORI SEPARATION OF DOUBLE LAYER CHARGING
Gilles G. Susbilles and Paul Delahay Jun. 1966 24 p refs
Submitted for Publication
(Contract Nonr-285(65))
(TR-2; AD-635801) CFSTI: HC $1.00/MF $0.50

Theory of relaxation electrode processes is developed on the basis of three, previously reported, general equations for a linearized current-overvoltage characteristic and for the following perturbations: Single step galvanostatic, double step galvanostatic, coulostatic decay with charge injection either by a square current pulse of a delta-function pulse, and single step potentiostatic. Results are compared with earlier results derived on the assumption of a priori separation of faradaic and charging processes. The error on kinetic parameters that affects some earlier results can be serious. Methods for analysis of experimental results are described for each method and for combinations of methods. Numerical examples are given. Author (TAB)

N67-12074*# Rensselaer Polytechnic Inst., Troy, N. Y.
[INTERDISCIPLINARY MATERIALS RESEARCH INCLUDING FUNDAMENTAL PHYSICS AND CHEMISTRY OF MATERIALS, ENVIRONMENTAL EFFECTS AND RELATED PROBLEMS] Semiannual Progress Report, Mar. 1–Aug. 31, 1966
S. S. Sternstein Sep. 1966 19 p refs
(Grant NsG-100-60)
(NASA-CR-79755) CFSTI: HC $1.00/MF $0.50 CSCL 07D

Continuing research in the following fields is summarized: mechanical properties of polymers, interaction of dislocation with the discrete second-phase particles in dispersion-strengthened alloys, mechanisms of solidification, ultrasonic research, ultrasonic pulse interferometry, relation of molecular structure and intermolecular action in flow of polymers and polymer dispersions as a function of temperature and shear rate, the influence of deformation mode on the ductile to brittle transition of FeCo–V alloys, low temperature physics, pyrolytic materials, dispersion-strengthened materials, metallic dissolution, nuclear magnetic resonance research, X-ray scattering, thermal properties of polymers, glass and nonmetallic materials, vibrational spectroscopy of inorganic substances in the vapor phase, irreversible thermodynamics of the solid state of linear high polymers, thermal decomposition of inorganic coordination compounds, electron-spin resonance, and polymer characterization. L.E.W.

N67-12123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY OF DERIVATIVES OF TRIFLUOROMETHYLSULFENYL CHLORIDE
D. D. Lawson and J. D. Ingham *In its* Space Programs Sum. no. 37–40, Vol. IV 31 Aug. 1966 p 93–95 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Derivatives of trifluoromethylsulfenyl chloride are investigated by nuclear magnetic resonance spectroscopy to (1) increase the chemical shifts resulting from specific structural perturbations and (2) determine structures in the vicinity of groups or segments along the polymer chains in addition to the terminal hydroxyl groups. A reaction which yields an alkyl trifluoromethylsulfenate ester is investigated, and the large difference in chemical shifts could be attributed to partial intramolecular association of the fluorines and the nearest methyl or methylene protons. Although positive assignments have not yet been established, the resulting doublets indicated for the mixed primary-secondary esters probably arise from the formation of both primary and secondary monodiesters, and the doublet from the thiol product may represent primary and secondary products. M.W.R.

N67-12124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE REACTION OF CARBOXYL AND AMINO TERMINATED PREPOLYMERS WITH POLYEPOXIDES
S. H. Kalfayan and B. A. Campbell *In its* Space Programs Sum. no. 37–40, Vol. IV 31 Aug. 1966 p 95–98 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Prepolymer-epoxide reactions are discussed, and the catalysis of the carboxyl-epoxide reaction is reported for Telagen CT, a carboxyl-terminated poly(butadiene), with two epoxides and various acid and base catalysts. Homopolymerization of the epoxides, with and without catalysts, is reported, along with the results of thermal sterilization of some of the products obtained. Thermal sterilization increased the hardness of the four prepolymers studied: (1) HC 134, (2) Telagen CT, (3) Butarez CTL, and (4) Polyetherdiamine L-3. Percent weight losses were usually low because of the thermal pretreatment given the samples. M.W.R.

N67-12131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
REACTION OF O(^{1}D) WITH HYDROGEN. PART II: THE UNSCAVENGED CASE
W. B. De More *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 136–141 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Experiments to determine the nature of the observed chain reaction and the identity of chain carriers when H atoms not scavenged by O_3 react with O_3 to initiate a chain decomposition of the O_3 which consumes at least 25 O_3 molecules per H atom. No evidence can be found for any terminating process other than O_2 inhibition; and since chain propagation involves a reaction with O_3, the number of chain cycles is proportional to the ratio of O_3/O_2. Chain stoichiometry is discussed, and results of a water analysis in the partly-scavenged cases show that water yield decreases with increasing chain contribution. It is concluded that the chain stoichiometry is O_3–3/2 O_2. M.W.R.

N67-12163*# Idaho State Univ., Pocatello. Dept. of Chemistry.
THE REACTIONS PERTAINING TO ZINC–SILVER AND CADMIUM–SILVER BATTERIES Quarterly Report
G. Myron Arcand 15 Aug. 1966 21 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951458)
(NASA-CR-80139; QR-2) CFSTI: HC $1.00/MF $0.50 CSCL 07D

Zn(II) precipitated with KOH was found to be predominantly ZnO. Zn(II) precipitated with NH_3 was found to be predominantly $Zn(OH)_2$; as much as 92% of the precipitate was the hydroxide in some cases. Cd(II) precipitated with KOH was found to be

about 50% or more $Cd(OH)_2$. The fairly pronounced temperature effect has not been verified. AgO decomposes at a detectable rate at temperatures as low as 80°. The rate may be a serious obstacle to heat-sterilization of dry-charged batteries at temperatures above 100°. Author

N67-12176*# Stanford Research Inst., Menlo Park, Calif.
SYNTHESIS OF ATACTIC AND STEREOREGULAR VINYLAROMATIC POLYMERS AND A STUDY OF THEIR REACTIONS WITH ALKALI METALS. PART Ia Summary Report
Jorge Heller and Donald B. Miller 31 Aug. 1966 29 p refs
Prepared for JPL
(Contracts NAS7-100; JPL-951326; SRI Proj. FRD-5775)
(NASA-CR-80125) CFSTI: HC $2.00/MF $0.50 CSCL 07C

Studies concerned with the synthesis and characterization of substantial amounts of vinylaromatic polymers are summarized. It is reported that polymerizations of 1-vinylnaphthalene, 2-vinylnaphthalene, and 4-vinylbiphenyl were carried out using living polymer techniques under an inert atmosphere with butyllithium in benzene. Narrow distribution molecular weight polymers of different molecular weight were prepared, fractionated, and characterized by gel permeation chromatography. Detailed characterization of all polymer samples that were synthesized are shown in tabular form. A.G.O.

N67-12197# Picatinny Arsenal, Dover, N. J. Pyrotechnics Lab.
DEVELOPMENT OF BURNING-TYPE COLORED SMOKES
Everett D. Crane, Burton Werbel, and Garry Weingarten Aug. 1966 50 p refs
(PA-TR-3273; AD-637790) CFSTI: HC $3.00/MF $0.75

Five different colored smoke compositions with 2- to 3-inch-per-minute burning rates were developed and tested for the 2.75-inch low-spin folding fin aircraft rocket (LSFFAR). Acceptable colors and volumes were obtained. The compositions developed were SR-207 (red), SY-211 (yellow), SG-172 (green), SV-16 (violet), and SB-9 (Blue), each containing appropriate dyes combined with various proportions of potassium chlorate, sugar, and vinyl alcohol acetate resin (VAAR). Increasing the loading pressure from 9,000 to 45,000 psi decreased the burning rate by 10–12% and reduced the volume by 20% without ignition or other difficulties. In the potassium chlorate/sugar binaries studied (40/52 through 75/25), the burning rate increased with increasing oxidant. Replacing small portions of the sugar with sodium bicarbonate or VAAR slowed the burning rate, while 1-methylaminoanthraquinone gave higher burning rates. Replacing small portions of the sugar with sodium bicarbonate or VAAR lowered the burning rates, while sugar of sulfur increased the burning rates. Various methods for standardizing the tests were investigated and applied. Author (TAB)

N67-12213*# National Bureau of Standards, Washington, D. C.
ELECTROCHEMICAL DATA. PART IV Quarterly Report, Jul. 1–Sep. 30, 1966
Harold J. De Wane and Walter J. Hamer 12 Oct. 1966 7 p
(NASA Order R-09-022-029)
(NASA-CR-79513; NBS-9432) CFSTI: HC $1.00/MF $0.50 CSCL 07D

The present report summarizes the work on the electrolytic conductance of hydrochloric acid. It is based on a study of the literature from 1925 to 1965. Rounded values of the equivalent conductance are given at temperatures from −20 to 65°C, and over the concentration ranges covered by the experimental data reported in the literature. They were obtained by the same methods described in Part III of this series, which covered the data at 25°C. Author

N67-12214*# Oak Ridge National Lab., Tenn.
LITERATURE SURVEY OF RADIOCHEMICAL CROSS-SECTION DATA BELOW 425 MeV
H. W. Bertini, M. P. Guthrie, E. H. Pickell, and B. L. Bishop Oct. 1966 59 p refs
(NASA Order R-104(1); Contract W-7405-ENG-26)
(NASA-CR-79100; ORNL-3884) CFSTI: HC $3.00/MF $0.75 CSCL 07E

Results of a literature survey of radiochemical cross sections below 425 MeV are given in tabular form. The cross-section data are tabulated for reactions involving incident protons, neutrons, and π mesons in the energy range from about 20 to 400 MeV interacting with nuclei ranging from lithium to the heaviest weight elements. Author

N67-12222*# Grace (W. R.) and Co., Clarksville, Md. Research Div.
SYNTHESIS OF LINEAR, DOUBLE CHAIN, LADDER POLYMERS FROM SUBSTITUTED TETRAPHOSPHONITRILLES Quarterly Progress Report, Jun.–Aug. 1966
Bernard Grushkin and Robert M. Murch 21 Sep. 1966 14 p refs
(Contract NASw-1415)
(NASA-CR-79280) CFSTI: HC $1.00/MF $0.50 CSCL 07C

A mixture of $[CH_3PN(NH_2)]_3$, 4 has been prepared. The amide as well as the chlorocompound is hydrolytically unstable. The amide, when heated above 150°C eliminates ammonia and when heated above 400°C eliminates ethylene. Large amounts of β-trans-$[OPNCl]_4$ and β-trans-$[OPNNH_2]_4$ have been prepared. Ammonia elimination from the tetrakisamide begins at about 200°C. Elimination of ammonia at the lower temperatures, 209° to 230° results in the formation of low molecular weight soluble polymers with a degree of polymerization primarily of 2 to 5 as well as a chloroform insoluble polymer. Author

N67-12261*# Grace (W. R.) and Co., Clarksville, Md.
SYNTHESIS OF LINEAR, DOUBLE CHAIN LADDER POLYMERS FROM SUBSTITUTED TETRAPHOSPHONITRILES Annual Report, 3 May 1965–2 May 1966
Bernard Grushkin and Robert M. Murch 23 Aug. 1966 72 p refs
(Contract NASw-924)
(NASA-CR-79273; AR-2) CFSTI: HC $3.00/MF $0.75 CSCL 07C

The objective is to prepare a new class of double-bridged ladder-type polymers from tetrafunctional phosphonitrilic tetramers. Three isomers of 2,4,6,8-tetrachloro-2,4,6,8-tetraphenyltetraphosphonitrile $[OPNCl]_4$, were isolated and structurally identified. The β-*trans* isomer was converted to the tetraamide which, by thermal deammoniation, would be converted to a polymer. The following accomplishments have been made: (1) By thermally polymerizing β-*trans*-$[OPNNH_2]_4$ a soluble polymer of 20,000 MW has been obtained. (2) The above polymer was found to eliminate benzene above 400° C. (3) Synthesis of non-geminal tetrachlorotetramethyltetraphosphonitrile, $(CH_3PNCl)_4$, has been accomplished; however, the compound is hydrolytically unstable. Author

N67-12269*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
SYNTHESIS OF FERROCENE-NITROGEN-CONTAINING POLYMERS WITH CONJUGATED BONDS.
T. P. Vishnyakova, I. A. Golubeva, and Ya. M. Paushkin Redstone Arsenal, Ala., Redstone Sci. Inform. Center, 19 Oct. 1966 16 p refs Transl. into ENGLISH from Vysokomol. Soedineniya (USSR), v. 8, no. 1, 1966 p 181–185
(NASA-TM-X-59134; RSIC-597) CFSTI: HC $1.00/MF $0.50 CSCL 07C

New ferrocene-nitrogen-containing polymers with conjugated double bonds—polyferrocenenitriles—were synthesized coming from amides and ammonium salts of ferrocenecarboxylic acids and

also directly from ferrocene and complexes of carbamylchloride with zinc chloride. The influence of the reaction conditions (temperature, reaction time, reagents ratio) on the polymer yield was studied. All polymers show narrow one component signal of EPR spectrum with concentration of 10^{17}–10^{20} spins/g. The electroconductivity varies exponentially with the temperature. Author

N67-12297# Oregon State Univ., Corvallis. Radiation Center.
EXPOSURES OF BIOLOGICAL SYSTEMS TO INORGANIC FLUORIDE OXIDIZING AGENTS. VOLUME I: HANDLING AND EXPOSURE TECHNIQUES
Frank N. Dost, Donald J. Read, and Chih H. Wang Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 28 p refs
(Contract AF 33(615)-1799)
(AMRL-TR-65-223, Vol. I; AD-631483) CFSTI: HC $2.00/MF $0.50

A system adaptable for diluting and distributing various inorganic fluoride oxidizing agents was developed. Known dilutions of these agents in nitrogen air are generated on the basis of flow rate ratios between undiluted gas and various diluent gases, and confirmed chemically. Problems of materials compatibility, personnel protection, stability of the agents and exposure system design are discussed. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N67-11263# Rydbeck Research Associates, Fjaeras (Sweden).
PROPAGATION OF LOW AND HIGH POWER RADIO WAVES IN IONIZED MEDIA Annual Summary Report No. 1, 1 Apr. 1965–31 Mar. 1966
Olof E. H. Rydbeck 6 May 1966 78 p refs
(Contract AF 61(052)-864)
(AFCRL-66-594; AD-637665) CFSTI: HC $3.00/MF $0.75

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6. TRANSIENT RESPONSE OF AN INHOMOGENEOUS, ISOTROPIC, IONIZED MEDIUM B. Ronnaeng p 55–65 refs (See N67-11269 02-07)

N67-11264# Rydbeck Research Associates, Fjaeras (Sweden).
AMPLIFICATION PROPERTIES AND SELF OSCILLATIONS OF THE PUMPED, IONIZED MEDIUM
Jan Askne *In its* Propagation of Low and High Power Radio Waves in Ionized Media 31 May 1966 p 1–10 refs (See N67-11263 02-07) CFSTI: HC $3.00/MF $0.75

A generalized Oseen extinction theorem was utilized to analyze amplification properties and self oscillations of a pumped, ionized plasma of finite width. All higher order side bands of the forward and backward waves were taken into account for different interactions to find the proper dispersion relations from which wave amplification properties, and the amplitudes of the various sum and difference frequency waves could be deduced. This analysis applied to the case where waves were propagating perpendicularly to the static magnetic field and where the signal field propagated in the ordinary mode while the pump wave propagated in the extraordinary mode. G.G.

N67-11265# Rydbeck Research Associates, Fjaeras (Sweden).
BASIC PROPERTIES OF COUPLED WAVE EQUATIONS WITH VARIABLE COEFFICIENTS
Olof E. H. Rydbeck and Ake Hjalmarson *In its* Propagation of Low and High Power Radio Waves in Ionized Media 31 May 1966 p 11–39 ref (See N67-11263 02-07) CFSTI: HC $3.00/MF $0.75

Suitable linear combinations of partial wave field equations were used to obtain coupled first order wave solutions describing the magneto-ionic triple splitting. Partial wave fields were expressed in terms of homogenous or inhomogenous wave numbers for a case where magneto-ionic waves propagated at vertical incidence in a vertically stratified medium. Coupling coefficients of the Goesterling type appeared in coupled second order wave equations for total fields, but were not themselves characteristic for a magneto-ionic propagation at vertical incidence. G.G.

N67-11266# Rydbeck Research Associates, Fjaeras (Sweden).
COUPLED WAVES IN MAGNETO-IONIC MEDIA
Olof E. H. Rydbeck and Ake Hjalmarson *In its* Propagation of Low and High Power Radio Waves in Ionized Media 31 May 1966 p 40–46 ref (See N67-11263 02-07) CFSTI: HC $3.00/MF $0.75

Second order coupled equations were reduced to a characteristic set of an unsymmetric 2-wave system for analysis of magneto-ionic wave propagation in a stratified medium. Coupled wave equations were obtained for the horizontal components of a total electric field in which the electron density, the collision frequency, the direction, and the magnitude varied arbitrarily. G.G.

N67-11267# Rydbeck Research Associates, Fjaeras (Sweden).
COUPLED WAVES IN MEDIA WITH STREAMING ELECTRONS
Olof E. H. Rydbeck *In its* Propagation of Low and High Power Radio Waves in Ionized Media 31 May 1966 p 47–48 (See N67-11263 02-07) CFSTI: HC $3.00/MF $0.75

Application of coupled wave methods to the interaction problem between whistler modes and electron cyclotron waves, in a stationary ionized medium permeated by streaming electrons, proved that true travelling wave amplification takes place in the medium. The actual amount of amplification was determined as a function of the angle between the normal wave and the electron stream. G.G.

N67-11268# Rydbeck Research Associates, Fjaeras (Sweden).
WAVE PROPAGATION IN A DOUBLE HUMP, ISOTROPIC IONIZED MEDIUM
Olof E. H. Rydbeck and B. Roennaeng *In its* Propagation of Low and High Power Radio Waves in Ionized Media 31 May 1966 p 49–54 (See N67-11263 02-07) CFSTI: HC $3.00/MF $0.75

The propagation of radio waves in a double hump, isotropic layer was analyzed by matched wave function; considered were total transmission and reflection coefficients as viewed from outside the entire region. Determined were the complex frequencies of self-oscillation in the barrier and the rate of field decay, due to boundary leakage, as a function of the mode order. G.G.

N67-11289# Rydbeck Research Associates, Fjaeras (Sweden).
TRANSIENT RESPONSE OF AN INHOMOGENEOUS, ISOTROPIC, IONIZED MEDIUM
R. Roennaeng *In its* Propagation of Low and High Power Radio Waves in Ionized Media 31 May 1966 p 55–65 refs (See N67-11263 02-07) CFSTI: HC $3.00/MF $0.75

Transient plane, horizontal polarized wave propagation through an exponential plasma, and through a symmetric Epstein layer was studied for the case where both media are assumed to be isotropic and collision-free. In the first problem, the electric field, caused by an incident unit step modulated carrier was written as a convolution integral. By means of a unit step wave response, the monochromatic energy flow through the tunnel region was obtained. Transient wave propagation through the symmetric, ionized Epstein layer resulted in the disappearance of the Fresnel-type interference pattern of the reflected wave when the wave frequency approached the penetration frequency. G.G.

N67-11293# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDIES AND RESEARCH IN ASTRONOMY
26 Mar. 1966 30 p refs Transl. into ENGLISH from Studii Cercetari De Astron. (Rumania), v. 9, no. 1, 1964 p 89–92, 101–111, and 113–120
(FTD-TT-65-848; TT-66-62108; AD-637435) CFSTI: HC $2.00/MF $0.50

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2. VISUAL OBSERVATIONS OF THE EARTH'S ARTIFICIAL SATELLITES MADE AT THE BUCHAREST ASTRONOMICAL OBSERVATORY, STATION 1131, BETWEEN 1 JANUARY AND 31 DECEMBER 1963 C. Popovici, M. Cirsmaru, A. Dinescu, and I. C. Singeorzan p 5–15 (See N67-11295 02-07)

3. VISUAL OBSERVATIONS OF ARTIFICIAL SATELLITES MADE AT STATION 1132 OF THE "BABES-BOLYAI" UNIVERSITY ASTRONOMICAL OBSERVATORY AT CLUJ IN 1962 G. Chis, I. Todoran, and A. Pal p 16–24 (See N67-11296 02-07)

N67-11294# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VISUAL-PHOTOGRAPHIC POSITION OBSERVATIONS OF ARTIFICIAL SATELLITES OF THE EARTH
Ion Corvin Singeorzan *In its* Studies and Res. in Astronomy 26 Mar. 1966 p 1–4 refs (See N67-11293 02-07) CFSTI: HC $2.00/MF $0.50

The principle of visual-photographic position observations on artificial orbiting satellites rests on prolonged photographic exposure of the satellite by a camera mounted parallel with a telescope whose eyepieces have been equipped with crosshair for point fixation. While the satellite is being followed with the telescope, a star is selected and the instrument fixed on it. The exposed photographic plate slightly elongates the star images in the camera field, as well as the point image at which the satellite was sighted at the moment of exposure. Transposition of the point image on the plate as a function of reference on a celestial atlas makes it possible to read the equatorial coordinates of the observed satellite. It is estimated that this method of visual-photographic position fixation has an accuracy whose error does not exceed ±0°.08. G.G.

N67-11295# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VISUAL OBSERVATIONS OF THE EARTH'S ARTIFICIAL SATELLITES MADE AT THE BUCHAREST ASTRONOMICAL OBSERVATORY, STATION 1131, BETWEEN 1 JANUARY AND 31 DECEMBER 1963
Calin Popovici, Magdalena Cirsmaru, Alexandru Dinescu, and Ion Corvin Singeorzan *In its* Studies and Res. in Astronomy 26 Mar. 1966 p 5–15 (See N67-11293 02-07) CFSTI: HC $2.00/MF $0.50

Presented are visual observation data on artificial earth satellites made at Bucharest Astronomical Observatory during the period January through December, 1963. Tables include the year of launch, code designation, universal time of observation, data of observation, magnitude, right ascension, and declination. G.G.

N67-11296# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VISUAL OBSERVATIONS OF ARTIFICIAL SATELLITES MADE AT STATION 1132 OF THE "BABES-BOLYAI" UNIVERSITY ASTRONOMICAL OBSERVATORY AT CLUJ IN 1962
Gheorghe Chis, Ioan Todoran, and Arpad Pal *In its* Studies and Res. in Astronomy 26 Mar. 1966 p 16–24 (See N67-11293 02-07) CFSTI: HC $2.00/MF $0.50

Visual observation data on artificial satellites made at the Cluj Astronomical University Observatory during 1962 are presented. All in all, 1478 visual observations on 19 artificial satellites were performed. Tables of observations include: observation data, launching year and order of launching for observed objects, universal time, estimated magnitude and equatorial coordinates, numerical evaluations; and the name of the observer. G.G.

N67-11307# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACADEMY OF SCIENCES OF THE USSR. INSTITUTE OF INFORMATION TRANSMISSION. PROBLEMS OF INFORMATION TRANSMISSION
10 Aug. 1965 34 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Lab. Sistem Peredachi Informatsii, Probl. Peredachi Informatsii (USSR), no. 15, 1963 p 61–74
(FTD-TT-65-980; TT-65-63837; AD-620785) CFSTI: HC $2.00/MF $0.50

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1. ONE METHOD OF CORRECTING A BUNDLE OF ERRORS O. V. Popov p 1–20 refs (See N67-11308 02-07)

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N67-11308# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE METHOD OF CORRECTING A BUNDLE OF ERRORS
O. V. Popov *In its* Acad. of Sci. of the USSR. Inst. of Inform. Transmission Probl. of Inform. Transmission 10 Aug. 1965 p 1–20 refs (See N67-11307 02-07) CFSTI: HC $2.00/MF $0.50

A code is described which permits a simple correction for any multiple error packets arranged in various subblocks if their length does not exceed l, the length of a packet of errors, and if they occupy different positions in each subblock for any known order of alternating these positions. This class of error combinations is somewhat broader than the class of combinations possible in a multichannel system. Hence, the excessiveness of the code exceeds the excessiveness minimally needed for a multichannel system. However, it is smaller than the excessiveness which would be expected when using known codes of the same length. The code makes it possible to extend transmission and detect errors with total output from the regime of one of the channels. The code may be used when transmitting along several parallel channels as well as in a case where error packets of length to l arise independently in these channels. It permits correction of solitary and the detection of multiple error packets while

preserving the combination part. The code can also detect individual error packets of length to $l_1 = n > l$, correct individual error packets of length to l, and detect individual packets of length to $l_1 > l$. R.N.A.

N67-11309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RECOGNITION OF CONTINUOUS FUNCTIONS

V. G. Solomonov and L. V. Zakharova *In its* Acad. of Sci. of the USSR. Inst. of Inform. Transmission. Probl. of Inform. Transmission 10 Aug. 1965 p 21–28 refs (See N67-11307 02-07) CFSTI: HC $2.00/MF $0.50

Two variants of a device for recognizing continuous functions are described. The basic device incorporates a scanner which identifies from continuous visual samples, such as closed curves and simple geometric figures, any changes in curvature during movement along a contour. The scanned forms are then compared with knowns stored in the device's memory. In the first variant, the continuous functions themselves are considered. The second version recognizes functionals, i.e., discrete values of these functions. Block diagrams and details of each variant are given. R.N.A.

N67-11382*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A TWO-CHANNEL MONOPULSE REFLECTOR ANTENNA SYSTEM WITH A MULTIMODE LOGARITHMIC SPIRAL FEED

Paul A. Lantz Jun. 1966 54 p refs
(NASA-TM-X-55580; X-525-66-262) CFSTI: HC $2.50/MF $0.50 CSCL 09F

It is possible to excite multiarm planar logarithmic spiral antennas in various modes. These antennas can be used to feed reflectors for monopulse tracking and space data acquisition. This report reviews the basic theory of operation of these antennas, expands it, and describes a two-channel monopulse antenna system using a feed of this type. It also describes performance of an operational 85-foot diameter reflector antenna and discusses limitations of performance capability. Feeds of this type are shown to provide increased efficiency for paraboloidal reflector antennas, improved tracking capability, and simplicity of design. Author

N67-11681*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

ERROR BOUNDS FOR PARALLEL COMMUNICATION CHANNELS

Paul M. Ebert (Ph.D. Thesis) 1 Aug. 1966 89 p refs
(Grants NsG-334; NsG-496; NIH MH-04737-05; NSF GP-2495; Contract DA-36-039-AMC-03200(E))
(NASA-CR-79494) CFSTI: HC $3.00/MF $0.75 CSCL 17B

This report is concerned with the extension of known bounds on the achievable probability of error with block coding to several types of paralleled channel models. One such model is that of non-white additive Gaussian noise. We are able to obtain upper and lower bounds on the exponent of the probability of error with an average power constraint on the transmitted signals. The upper and lower bounds agree at zero rate and for rates between a certain R_{crit} and the capacity of the channel. The surprising result is that the appropriate bandwidth used for transmission depends only on the desired rate and not on the power or exponent desired over the range wherein the upper and lower bounds agree. We also consider the problem of several channels in parallel with the option of using separate coders and decoders on the parallel channels. We find that there are some cases in which there is a saving in coding and decoding equipment by coding for the parallel channels separately. We determine the asymptotic ratio of the optimum block-length for the parallel channels and analyze one specific coding scheme to determine the effect of rate and power distribution among the parallel channels. Author

N67-11690*# Alabama Univ., University. Systems Engineering Group.

A STATISTICAL INVESTIGATION OF THE EFFECTS CONTRIBUTED BY TAPE RECORDERS AND BY WOW AND FLUTTER OF MAGNETIC TAPE ON THE ACCURACY OF A TELEMETRY SYSTEM Technical Report No. 15

Marvin A. Griffin, Richard S. Simpson, H. Paul Hassell, Jr., John H. Horn, Jr., Harvey M. Donaldson et al Jul. 1966 63 p refs
(Contract NASS-20172)
(NASA-CR-79621) CFSTI: HC $3.00/MF $0.75 CSCL 09F

The effects contributed by analog tape recorders were investigated. Also, the noise contributed by the wow and flutter effect of magnetic tape was studied in relation to the accuracy of a telemetry system. Since the data collected for this experiment did not conform to a normal distribution, a non-parametric test was employed in testing for significant difference between the tape tracks and tape recorders, in regard to their noise indexes. The ratio of the standard deviation over the range was used as a relative measure of the error or noise effect in the system and provided the best information for ranking tape recorders and tape tracks in terms of system noise. A secondary experiment in noise analysis was performed in order to corroborate the results obtained in the original experiment. Author

N67-11691*# International Business Machines Corp., Rockville, Md. Federal Systems Div.

SPECIAL AROD SYSTEM STUDIES, VOLUME I Fifth Quarterly Report, Period Ending Dec. 31, 1964

15 Jan. 1965 90 p refs
(Contract NAS8-11050)
(NASA-CR-79751; IBM-TR-15-7, Vol. II) CFSTI: HC $3.00/MF $0.75 CSCL 09F

Investigations of wideband modulation techniques and phase-locked loop advanced circuits for airborne range and orbit determination (AROD) are discussed. Sidetone systems, pseudo-noise systems, and hybrid systems that combine periodic and pseudo-noise signals are analyzed. Principal conclusions were that: (a) sidetone systems can approach the AROD accuracy objectives, but are too susceptible to cw interference; (b) a modulation system using only pseudo-noise signals cannot provide satisfactory tracking accuracy for AROD; and (c) hybrid systems can approach the AROD performance objectives and provide substantial interference rejection. Efforts to exploit memory in minimizing reacquisition problems after signal fade are reported. S.P.

N67-11700*# ITT Industrial Labs., Fort Wayne, Ind.

HIGH RESOLUTION NIGHTTIME CLOUD-COVER RADIOMETER Quarterly Report No. 18, Jan. 1–Apr. 1, 1966

P. C. Murray, W. H. Wallschlaeger, R. Harber, J. Whitacre, P. Eagle, et al 28 Sep. 1966 51 p
(Contract NAS5-868)
(NASA-CR-79368; QR-18) CFSTI: HC $3.00/MF $0.50 CSCL 09F

The accomplishments made on three modifications in the development of the radiometer are included in this report. Problem areas and resultant design changes are discussed. The engineering model was assembled and partially tested. Engineering drawings of components, and data from the tests conducted are included. H.S.W.

N67-11731*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

CATALOGUE OF SATELLITE OBSERVATIONS, NO. C-34

D. V. Mechau [1960] 25 p Prepared for NASA
(NASA-CR-79505; SAO Special Rept.-68) CFSTI: HC $1.00/MF $0.50 CSCL 17D

Satellite observations made by U.S. and foreign observatories from June through December 1960 are listed. The satellites are of the TIROS, TRANSIT, EXPLORER, GREB, and DISCOVERER series. Observations by military installations, Phototrack stations, and miscellaneous observers are included. K.W.

N67-11743# European Organization for Nuclear Research, Geneva (Switzerland). Proton Synchrotron Machine Div.
THE TIME-MULTIPLEXED PULSE TRANSMISSION SYSTEM "POLYCANAL"
H. Pfumm 9 Aug. 1966 40 p refs
(CERN-66-26)

A multiplex transmission system operating on the basis of time division and transmitting timing pulses is described. The transmitted pulses conserve their qualities as regards shape and time stability in reference to the proton synchrotron cycle. A first system with 60 channels has recently been put into operation for the remote control of ejection magnets and their power supply. The transmission of analog information is envisaged. Author

N67-11848*# National Bureau of Standards, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.
SECONDARY IRREGULARITIES IN THE EQUATORIAL ELECTROJET
Robert Cohen and Kenneth L. Bowles [1966] 28 p refs
Submitted for Publication
(NASA Order R-83)
(NASA-CR-79914) CFSTI: HC $2.00/MF $0.50 CSCL 21N

Areas of agreement and residual points of disagreement between available theory and experiment are defined for secondary equatorial-electrojet irregularities, and experimental knowledge on the subject is reviewed. Instrumentation techniques and autocorrelation analysis procedures are considered, and spectral results for primary irregularities are recapitulated. Spectral characteristics of the secondary irregularities are depicted. General agreement with theory was obtained, although it was noted that an unexplained tendency exists for asymmetry in the nature of the irregularities traveling upward compared to those moving downward. It is pointed out that this asymmetry may be accounted for by the variation with height of the physical properties of the instability region. M.G.J.

N67-11852*# Texas Univ., Austin. Electrical Engineering Research Lab.
REMOTE DETECTION OF CLEAR AIR TURBULENCE. PART I: PULSED MICROWAVE RADARS
B. M. Fennin 1 Nov. 1966 32 p refs
(Grant NGR-44-012-048)
(NASA-CR-79922; P-13) CFSTI: HC $2.00/MF $0.50 CSCL 17I

Available models of the clear air turbulence (CAT) were used to estimate the backscattering of microwaves from such turbulence. The expected mean returned power relative to the minimum detectable level was calculated, and the chosen values of the contributing parameters are discussed. It is found that operational systems for normal jet flights, constrained by reasonable limits on weight, size, power, and cost, are not feasible; but research-type ground-based systems should be capable of reliable detection of CAT for wavelengths from a few centimeters to a few meters. However, for the ground-based systems, near state-of-the-art performance and generally favorable conditions were assumed, including pointing at the zenith, cloudless sky, and pointing away from the galactic plane. K.W.

N67-11854*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
TERRAIN ANALYSIS BY ELECTROMAGNETIC MEANS Technical Report, Nov. 1964–Apr. 1965
J. R. Lundien Sep. 1966 98 p refs
(NASA Order R-25-04-001)
(NASA-CR-79924; TR-3-693; Rept.-2) CFSTI: HC $3.00/MF $0.75 CSCL 17I

Laboratory tests were conducted with radar sensors to detect subsurface interfaces when the surface was bare, and to determine the influence of vegetation at various stages of growth on radar responses. A secondary purpose was to continue earlier studies to relate radar returns and the electrical constants they provided to moisture content and density of samples. Standard pulsed radar sensors operating with frequencies of 297, 5870, 9375, and 34,543 megacycles/sec and directed at various angles of incidence to the surface were employed. The results indicate that the standard pulsed radar sensors permit an estimate of the moisture content of deep, homogeneous soil samples and detection of surface vegetation of various heights. Radar signatures of vegetation-covered soil were more significantly altered at Ka-, X-, and C-band frequencies than at P-band frequencies. The systematic manner in which soil depths were varied permitted an analytical solution and led to the conclusion that properly designed radar systems could measure depths to subsurface interfaces. Three such systems are proposed. Author

N67-11857*# Northeastern Univ., Boston, Mass.
IMPLEMENTATION AND PERFORMANCE OF THE MAXIMUM-LIKELIHOOD DETECTOR IN A CHANNEL WITH INTERSYMBOL INTERFERENCE
Robert A. Gonsalves Aug. 1966 39 p refs
(Grant NGR-22-011-013; Contract AF 19(628)-3312)
(NASA-CR-79927; SR-5; AFCRL-66-586) CFSTI: HC $2.00/MF $0.50 CSCL 09D

It is shown that the maximum-likelihood (ML) detector for noisy, binary channel with restricted intersymbol interference (ISI) consists of a matched filter followed by a tapped delay line. The useful output is a nonlinear function of the tap outputs. Bounds on the per-symbol probability of error indicate that a gross approximation to the ML detector performs as well as an optimum linear detector. The major assumptions are (1) bi-polar binary signals, (2) ISI only between adjacent bounds, (3) stationary additive white, Gaussian noise, and (4) perfect synchronization. Extensions are suggested to remove assumptions (1) and (2) and to handle stationary, non-white Gaussian noise. Author

N67-11859*# Houston Univ., Tex. Cullen Coll. of Engineering.
ANALYTIC SIGNALS AND ZERO-LOCUS IN MULTIPLEXING SYSTEMS
Louis C. Puigjaner (M.S. Thesis) Aug. 1966 202 p refs
(Grant NGR-44-005-039)
(NASA-CR-79929) CFSTI: HC $6.00/MF $1.25 CSCL 09D

The theory of analytic functions is used as an approach to the study of conventional multiplexing schemes. The multiplexing process involves double and triple modulation techniques. The most general forms of modulated waves exhibit simultaneous phase and envelope fluctuation. Phase and envelope relationships are described in mathematical formulation and have a strong dependence on the real and complex zeroes of the actual wave. The properties of analytic signals are studied, yielding a general theory of zero representation of the original signal that contains its informational attributes. The zero representation is used to study different forms of modulated waves based on the principle of factorization in terms of the Fourier series expansion and in the property of zero-pattern superposition resulting from the product of two signals. Special attention is given to crosstalk effects. A computer program was developed to yield the "zero locus" of the modulated waveform. Included are guidelines to compute interchannel crosstalk. K.W.

N67-11866# National Research Council of Canada, Ottawa. Radio and Electrical Engineering Div.
TELEMETRY SYSTEMS FOR GUN-LAUNCHED UPPER ATMOSPHERE PROBES
J. K. Pulfer Jun. 1966 35 p refs
(ERB-742) CFSTI: HC $2.00/MF $0.50

A study of the various aspects of telemetry systems suitable for use in gun-launched upper atmosphere probes was conducted. This report describes some of the results of the study. The types of experiments currently being conducted in rockets and balloons

are listed, and the problems encountered in performing them in a high-g environment are considered. Some conclusions are reached concerning the type of telemetry system most suitable for gun-launched probes, taking into account the state of the art in vehicle performance, components, and sensors, and estimated telemetry requirements. Author

N67-11874# Radio and Space Research Station, Slough (England).
OPTICAL OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FOR THE MONTH OF JUNE 1966 AND SUPPLEMENTARY OBSERVATIONS FOR THE MONTHS OF MARCH, APRIL, MAY 1966
[1966] 50 p
CFSTI: HC $2.00/MF $0.50

Data from optical observations of the following satellites are tabulated: Gamma 2, Iota 2, Eta 3, Zeta 1, Alpha 1 and 2, Alpha-Delta 1, Kappa 1, Omicron 1, Beta Alpha 2, Beta Kappa 1, Beta Tau 2, Beta Tau 6, Beta Psi 1, 03A, 22A, 24A, 26A, 27A, and 30A. Supplementary observations are included for the 05A, 95A, 95B, Beta Mu 1, Alpha 1, Beta Tau 6, and 105B satellites. C.T.C.

N67-11877# Weapons Research Establishment, Salisbury (Australia).
THEORETICAL INFLUENCE OF A WAKE ON THE LEADING-EDGE OF A RADAR RETURN FROM A SPARTA RE-ENTRY VEHICLE
B. A. Francis Oct. 1966 12 p refs
(WRE-TN-PAD-124) CFSTI: HC $1.00/MF $0.50

The purpose of this paper is to study the influence of a wake on the position of the leading-edge of the radar return from a reentry head. Despite the fact that the return from the wake is received at a greater delay than that from the head, the finite bandwidth of the rader system can cause the wake to have an effect on the leading-edge of the head return. The apparent change in position of the leading-edge of the head return, as seen by a leading-edge tracker, is first calculated using a simple wake model; the effects of variation from this ideal are then considered. Post trial computer tracking is discussed and equipment modifications are suggested. Author

N67-11878# Royal Aircraft Establishment, Farnborough, (England).
A NOMOGRAM FOR A SINGLE-PATH LINE-OF-SIGHT RADIO LINK FOR THE FREQUENCY RANGE 100 MC/S TO 100 GC/S
G. May Mar. 1966 8 p ref
(RAE-TR-66091) CFSTI: HC $1.00/MF $0.50

A nomogram is presented which enables calculation of the signal-to-noise ratio for a given set of parameters on a single path line-of-sight radio link. The method of constructing the nomogram is briefly described and an example of its use is given. Author

N67-11914# Radio and Space Research Station, Slough (England).
KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR JUNE 1966
1966 39 p *Its* Issue No. 18
CFSTI: HC $2.00/MF $0.50

Tables detail kinetheodolite observations received from the Malta tracking station on the time, azimuth, and elevation of various United States and Russian satellites and Rockets in orbit during the period from June 1 through June 22, 1966. Satellites and rockets that were launched between 1960 and 1965 are included, and refraction corrections have been applied to the observations. M.W.R.

N67-11915# Radio and Space Research Station, Slough (England).
KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR JUNE AND JULY 1966
1966 61 p *Its* Issue No. 19 For Abstract See N67-11914 02-07
CFSTI: HC $3.00/MF $0.75

N67-11918# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
VERY SHORT SPIRAL CONICAL ANTENNA [ANTENNE ULTRA COURTE A SPIRALE CONIQUE]
Roger Gouilou 1966 20 p *refs* In FRENCH Presented at the Symp. of the Electron. Group of AGARD, "Antennas for Airplanes and Space Vehicles", Duesseldorf, 7–13 Jul. 1966
(TP-373(1966)) CFSTI: HC $1.00/MF $0.50

A very short conical spiral antenna is discussed which can provide solutions of a more general nature than the usual antennas of small dimension, and can obtain responses for specialized needs. A number of models of the antenna are realized, and their performance is in good agreement with theoretical predictions. A high degree of efficiency is reported for the specialized applications for which the antenna can be used. Attention is also given to the performance characteristics and problems associated with other shaped antennas, such as vertical, ring, and spiral plate; and the theory which explains their functioning is reviewed. Theory permits the calculation of efficiency and frequency band of each of these shapes as well as for the conical spiral antenna; and the radiation pattern can also be determined. Transl. by M.W.R.

N67-11971# European Space Research Organization, Paris (France).
INTRODUCTION TO SYNTHESIS OF RADIO GUIDANCE AND TRACKING STATIONS
R. Cossart Sep. 1966 79 p refs
(ELDO-TM-F-17) CFSTI: HC $3.00/MF $0.75

In order to provide the nonspecialist with an insight into the choice of the basic station parameters, a review of elementary theory on radio guidance and tracking stations is presented. The presentation is intended to be of direct interest to studies on radio guidance and tracking stations. Author

N67-11980# Academy of Sciences (USSR), Moscow. Astronomical Committee.
RESULTS OF OBSERVATIONS ON ARTIFICIAL EARTH SATELLITES, NO. 70
1964 65 p In RUSSIAN
CFSTI: HC $3.00/MF $0.75

Presented are the observed equatorial and horizontal coordinates, April 1963, and the horizontal coordinates, May 1963, for Sputnik 1960 Epsilon and Cosmos II, VIII, X, XI, XVII, and XVIII. Transl. by K.W.

N67-11991# Academy of Sciences (USSR), Moscow. Astronomical Committee.
RESULTS OF ORBSERVATIONS ON ARTIFICIAL EARTH SATELLITES, NO. 70
1964 70 p In RUSSIAN
CFSTI: HC $3.00/MF $0.50

Equatorial coordinates are given of observations during May 1963 for Sputnik 1960 Epsilon, and Cosmos II, XIV, XVII, and XVIII. Transl. by K.W.

N67-11992# Academy of Sciences (USSR, Moscow. Astronomical Committee.
RESULTS OF OBSERVATIONS ON ARTIFICIAL EARTH SATELLITES, NO. 72
1964 47 p In RUSSIAN
CFSTI: HC $2.00/MF $0.50

Equatorial and horizontal coordinates are given of observations during June 1963 for Sputnik 1960 Epsilon, Vostok V, and Cosmos II, VIII, XIV, and XVII. Transl. by K.W.

N67-11993# Academy of Sciences (USSR), Moscow. Astronomical Committee.
RESULTS OF OBSERVATIONS ON ARTIFICIAL EARTH SATELLITES, NO. 73
1964 47 p In RUSSIAN
CFSTI: HC $2.00/MF $0.50

Presented are equatorial and horizontal coordinates for July 1963 and additions for several other months of 1963 for Sputnik 1960 Epsilon and Cosmos II, XIV, and XVII. Transl. by K.W.

N67-11994# Academy of Sciences (USSR), Moscow. Astronomical Committee.
RESULTS OF OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES, NO. 74
1964 63 p In RUSSIAN
CFSTI: HC $3.00/MF $0.75

Equatorial and horizontal coordinates are given of observations during August and September 1963 for Sputnik 1960 Epsilon and Cosmos II, XVII, and XIX. Transl. by K.W.

N67-12042*# Ohio State Univ. Research Foundation, Columbus. Dept. of Electrical Engineering.
HIGHER-ORDER DIFFRACTION CONCEPT APPLIED TO PARALLEL-PLATE WAVEGUIDE PATTERNS
R. C. Rudduck and J. S. Yu 15 Oct. 1965 34 p refs
(Grant NsG-448)
(NASA-CR-79408; Rept.-1691-16) CFSTI: HC $2.00/MF $0.50
CSCL 20N

A method for computing the radiation patterns of parallel-plate waveguide apertures is presented. This method, which is based on edge diffraction theory, employs the higher-order diffraction concept. This concept permits the summation of all orders of diffraction in closed form. Calculated waveguide patterns are compared with those obtained by using the first three orders of diffraction. This method is also applicable to other types of diffracting structures. Computations obtained by this method are, in general, quite accurate. However, the assumption is made that multiple diffractions are the same as those of isotropic line sources; this approximation leads to inaccurate results in some cases. Author

N67-12047*# TRW Systems, Redondo Beach, Calif.
ADVANCED PLANETARY PROBE STUDY. VOLUME 4: APPENDIXES
27 Jul. 1966 225 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951311)
(NASA-CR-79504; TRW-4547-6007-RO000) CFSTI: HC $6.00/MF $1.25 CSCL 09F

The basic concepts of the conical scanning system for the Advanced Planetary Probe are summarized, and radiation patterns are discussed. Conical scan signal processing techniques are discussed in relation to the presence of significant amounts of noise. The problems involved in using the helix antenna for fine pointing are considered, and details are given on the conical scan angle tracker. The results of a brief S-band power amplifier survey are presented, which included tunnel diodes, transit time devices, transistors, diode multipliers, up-converters, vacuum tube triodes, klystrons, amplitrons, and traveling wave tubes. Modulation and bit synchronization is considered, including two-channel and single-channel synchronization, suppressed carrier techniques, and coding. Antenna temperature is computed when the ground or spacecraft antenna is pointed at the sun or Jupiter. A midcourse propulsion system error analysis is presented, and a computer program to rapidly assess reliability of complicated systems is given. Finally, nongravitational trajectory perturbations are considered in detail. L.E.W.

N67-12065# Electronic Associates, Inc., Princeton, N. J.
VOICE ACTUATED ADDRESS MECHANISM Final Report, 1 Mar. 1965–28 Feb. 1966
Donald Freipont 31 Mar. 1966 43 p refs
(Contract DA-28-043-AMC-01223(E))
(Rept.-3; AD-633711) CFSTI: HC $2.00/MF $0.50

This is the third and final progress report relating to the development of a Simulation of a Voice Actuated Address Mechanism. An overall summary of the entire project is included here along with the third phase experiments of the simulation. All third phase work was pointed toward improving the extrapolated recognition rate to a practical field usage level. The final results obtained for ten new speakers each voicing the fifteen word vocabulary twice were: Recognition Rate = 87.3%, Reject Rate = 6.7%, Error Rate = 6.0%. These results, while not yet at a field use level, are better than any previously published figures relating to similar experiments. Author (TAB)

N67-12068*# Advanced Technology Corp., Timonium, Md.
SUBMILLIMETER SATELLITE RADIOMETER Final Engineering Report
R. F. Packard, M. Cohn, R. J. Bauer, J. M. Cotton, Jr., L. E. Dickens et al 29 Jul. 1966 149 p refs
(Contract NASw-1000)
(NASA-CR-79739; Rept.-50.101-21) CFSTI: HC $4.00/MF $1.00
CSCL 20F

An experimental program to determine the feasibility of developing an all solid-state superheterodyne Dicke radiometer operating at a wavelength of about 0.5 mm was completed. The critical components of the radiometer are the harmonic mixer and the final multiplier stage of a solid-state local oscillator source. A 560 GHz fourth harmonic mixer having a conversion loss of 29.5 dB with an LO drive level of 10 mW was developed. An experimental epitaxial GaAs varactor having a zero bias cutoff frequency of about 1000 GHz was developed. This varactor was incorporated in a 70 to 140 GHz frequency doubler, which yielded an output of 10 mW for an input of 40 mW (25% efficiency). With devices having these characteristics a sensitive submillimeter radiometer receiver could be built. It would have a calculated minimum detectable temperature $(\Delta T)_{min}$ of 7°K for a signal-to-noise ratio of unity. This calculated sensitivity is based on RF losses of 3 dB, mixer diode noise ratio of 2, IF noise figure of 4 dB, IF bandwidth of 1.6 GHz, and output integration time of 10 sec. Author

N67-12104*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT ANTENNA POINTING
G. E. Fleischer *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 16–19 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The two degree of freedom pointing system is examined with respect to its geometry, errors caused by attitude drift, and methods of correcting antenna position for attitude drift using sensor error signals. Equations are given, and hinge and swivel angle error corrections are formulated. Figures are included to depict the earth coordinates for a 512-day Jupiter flyby, the nominal antenna hinge and swivel angles for Jupiter flyby, and the maximum pointing errors due to spacecraft attitude misalignments. M.G.J.

N67-12132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SYSTEM REORGANIZATION OF THE SPACECRAFT DATA ENCODER
J. R. Kinkel *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 143–154 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Simultaneous investigations were conducted on a system organization and its implementation, in order to localize multiplexer degradation in the presence of catastrophic component failures. As the performance of the multiplexer is heavily dependent on

device technology, implementation with integrated circuits is considered important. Characteristics of the metal-oxide-silicon field effect transistors (MOS FET) are examined, along with the most common failure modes. Analog to digital conversion (A/DC) failures are also considered, along with methods of reducing converter complexity. It is pointed out that A/DC conversion with integrated circuits is complicated by the dependence of the gate threshold voltage on temperature; this voltage variation is depicted. Functional behavior is discussed, with attention focussed on interleaving, subcommutation, and failure response. M.G.J.

N67-12134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE SPECTRUM OF SINGLE-SIDEBAND PHASE MODULATION BY NORMAL NOISE
J. C. Springett *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 163–169 refs (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

The noise spectrum of single sideband phase modulation (SSB/PM) was calculated to determine its applicability to capsule relay telemetry links and its advantages over double-sideband phase modulation (DSB/PM). A Gaussian modulating signal was chosen for study with the assumption that the proper choice of variance and spectral shape could approximate the actual modulating signal without significant error. The conditions necessary to achieve exact SSB/PM were explored and the second moment function for a Gaussian modulating signal was derived. Calculations for some specific modulating spectral shapes showed that bandwidth savings of 40% can be achieved even for high modulation index. It is concluded that the use of SSB might alleviate problems encountered when DSB/PM approaches the bandwidth constraint. S.C.W.

N67-12136*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANTENNA STRUCTURES: EVALUATION TECHNIQUES OF REFLECTOR DISTORTIONS
M.S. Katow and L. W. Schmele *In its* Space Programs Sum. No. No. 37-40, Vol. IV 31 Aug. 1966 p 176–184 refs (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

A modified root mean square (RMS) computer program used for evaluating the distortion of the reflective surface of a paraboloidal antenna is discussed. Basic mathematical formulations of the RF path length change are reviewed; and both a graphical and an analytical illustration of the change are depicted. Two methods of reducing the field data, the first using an accurate angle measuring theodolite rotatable around the axis of symmetry of the paraboloid, and the second using an accurately contoured template to check the surface distortions, are described. A graphical illustration of the RMS output data is depicted. Also depicted are the results of an RF boresight computation from the RMS output data and sample RMS contour levels plots outputted by the plotter from the IBM 7094 computer produced tape. In the first contour levels plot the path length errors were plotted after a best fit; in the other, the fitting paraboloid was aligned to the data plane. L.S.

N67-12137*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RF TECHNIQUES: 90-GC MILLIMETER WAVE WORK
C. T. Stelzried and W. V. T. Rusch *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 185–190 refs (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

A series of sky temperature measurements were made at 90–Gc with a radio telescope system consisting of a 60 inch millimeter searchlight antenna and a superheterodyne radiometer. A sample computer printout is shown for data taken on July 8, 1966. All observational data taken between February 9 and July 10, 1966 are presented in a table. The input data and computed data parameters are shown. The measured sky temperature was also plotted against thermal ground temperature, and a least squares best fit straight line is shown. L.S.

N67-12138*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RF TECHNIQUES: MISMATCH ERRORS ON NOISE TEMPERATURE MEASUREMENTS
T. Y. Otoshi *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 190–197 refs (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

The general-case equations applicable to the mismatch errors in Y-factor measurements for calibration of a receiver and also any unknown noise source which is connected to the receiver through a two-port network, are presented. Several examples are given which use reflection coefficients and typical Y-factors measured on the Mars Deep Space Station listening cone system. The results of calculation for the various sample cases are tabulated. From the examples it can be concluded that in order to reduce uncertainties in the absolute calibrations of the noise temperatures of unknown noise sources (including antennas), it is very important that the noise sources, noise source transmission lines, and receiver be well matched. L.S.

N67-12139*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW DATA RATE TELEMETRY RF SYSTEM DEVELOPMENT
R. B. Postal and C. M. Potts *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 198–201 (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

The electrical, environmental, and physical design goals of a 3- to 5-W solid state 2295 MHz high impact transmitter being developed as a subassembly for a telecommunication system capable of surviving a high impact on a lunar or planetary surface, are presented in a table. A block diagram of the S-band transmitter is depicted. Three separate modules which will house the transmitter circuitry, are described. The first module contains a 31.875 MHz FSK modulator/oscillator; the second module contains two 191-MHz power amplifiers and a varactor tripler; and the third module consists of an X4 varactor multiplier and associated isolator. Engineering models of modules I and II have already successfully passed 10,00 g impact tests, and further testing is being conducted on the 573-MHz tripler and FSK oscillator. L.S.

N67-12140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH IMPACT ANTENNA STUDY: COAXIAL CAVITY RADIATOR
K. Woo *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 201–206 refs (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

Preliminary high impact test results on a coaxial cavity radiator antenna are reported. Photographs of the radiator before and after impact, and of the antenna mounting fixture after impact are depicted. The radiation patterns of the right and left circularly polarized components taken before and after impact at 2298 MHz, along two mutually perpendicular cuts (clock angles 0 and 90 deg) are shown. On the basis of the results obtained, it was concluded that the antenna would have survived an actual high impact landing on a lunar or planetary surface if the same physical damage had been inflicted on it by the landing impact. Radiators of this type, with proper design, can be used as direct high impact survival antennas in future planetary landing missions. The electrical properties of this type of antenna are being further investigated. L.S.

N67-12141*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
COMBINATORIAL COMMUNICATIONS: SEARCH FOR CYCLIC HADAMARD MATRICES
R. Thoene and S. W. Golomb *In* JPL Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 207–208 Prepared for JPL (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25
(Contract JPL-951016)

The results of an effort to determine the existence of cyclic Hadamard matrices for values of N (which were heretofore unsettled) through the use of a difference set technique, are reported. The 250 cases considered were confined to $N \leq 1{,}000$. Even then, 54 of these cases could not be tested due to the time each would have required on the computer. Of the 196 remaining cases, 95 had already been settled by virtue of N–1 being prime of a twin prime product, or N being a power of 2. The 101 cases which could be tested in a reasonable length of computer time (seconds to 4 hrs; average less than 30 min) revealed that no cyclic Hadamard matrix derivable from a difference set (with $v = 4t - 1$, $k = 2t - 1$, and $\lambda = t - 1$) exists for these values.

N67-12142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMBINATORIAL COMMUNICATIONS: ENUMERATION OF A SPECIAL CLASS OF PERMUTATIONS
R. Stanley *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 208–214 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Pi (π) is said to be a permutation $a_1, a_2, \ldots, a_n$ of the symbols 1,2,...,n. Pi contains a run of length t, if for some i and k, $1 \leq i \leq n$, $1 \leq k \leq n$, and $a_i = k, a_{i+1} = k+1, \ldots, a_{i+t-1} = k+t-1$. The function F(n,t) which is allowed to denote the number of permutations of 1,2,...,n which contains no runs of length t (or greater) is estimated for the case where t=2. A recurrance relation was obtained for F(n,2), its generating function was computed, a closed expression is given for it, and its complete asymptotic expansion was derived. In particular, it is shown that the probability that a random permutation of 1,2,...,n has no runs of length 2, approaches 1/e as $n \to \infty$. Exact results were not achieved for t>2 because of the complexity of the situation, but the use of a principle of inclusion and exclusion enabled the development of method that yields the asymptotic expansion of F(n,t). Here the probability that a random permutation of 1,2,...,n has no runs of length t, t>2, approaches 1 as $n \to \infty$. L.S.

N67-12143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODING THEORY: MOMENTS OF WEIGHT DISTRIBUTIONS
R. Stanley *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 214–216 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25.

A general combinatorial formula is developed which allows calculation of sums of the type

$$\sum_{v \in S} [\sigma(v)]^t, \; 0 \leq t \leq r$$

where S is a set of vectors v, $\sigma(v)$ is the sum of the coordinates of v, and r is an integer depending on a special property of the set S. This formula is applied to (n,k) binary codes and yields explicit formulas for the sums

$$\sum_{i=0}^{n} i^t a_i, \; 0 \leq t < d$$

where a_i words of the code have weight i, and d is the minimum weight of the dual code. When enough information about a code is known, these equations may suffice to determine its weight distribution. As an example, the weight distribution of the dual Golay (23, 11) code is calculated without using J. MacWilliams' formula.
Author

N67-12144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODING THEORY: EFFICIENT SOLUTIONS OF EQUATIONS FOR DECODING
R. Mc Eliece *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 216–218 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A general approach to the problem of solving certain algebraic equations over finite fields of characteristic 2, of the type which turn up in decoding procedrues for Bose–Chaudhuri codes, is presented. Efficient explicit solutions to many of the equations are given, and the solutions are easily mechanized. It is indicated how the solutions represent a considerable saving of effort over previous methods. L.S.

N67-12145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODING THEORY: THE INDEX OF COMMA FREEDOM IN ITERATIVE CODES
J. Stiffler *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 218–219 ref (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The propagation of the comma-free properties of the component codes of iterated codes is demonstrated. A theorem proof is presented which shows that the index of comma freedom in an iterated code grows essentially as rapidly as the length of the code words in the process of iteration. The properties of iterated codes are summarized in another theorem for which a proof is also given. One of the chief advantages of iterated codes is the relative simplicity of the associated decoding algorithm. L.S.

N67-12146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL COMMUNICATION AND TRACKING: CALCULATION OF RANGE-CLOCK JITTER
R. C. Tausworthe *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 219–225 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The jitter in an RF carrier reference loop receiver used for tracking the relatively slowly-changing phase components of the input, and the jitter in the clock loop itself, are investigated from a theoretical viewpoint in order to be able to make an accurate analysis of clock-jitter for a ranging subsystem. Expressions for input power and variances are given. The clock-loop performance of the Mark I ranging system was then computed. The loop parameters of the system are presented in a table, and the acquisition profile is displayed. The resulting theoretical performance is depicted graphically for each stage in the acquisition procedure. L.S.

N67-12147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA COMPRESSION: A LOWER BOUND FOR EPSILON ENTROPY
E. Posner and H. Rumsey, Jr. *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 225–228 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

This article gives a lower bound for the asymptotic behavior of the epsilon entropy of a Gaussian stochastic process on the unit interval under square-error fidelity criterion. The lower bound is apperently weaker than the one previously obtained, but is easier to work with. Author

N67-12148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INFORMATION PROCESSING: A BIVARIATE GOODNESS-OF-FIT TEST
T. Pitcher *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 228–230 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A bivariate goodness-of-fit test, similar to the Kolmogoroff-Smirnoff univariate test which has been used in extreme-value applications to single-channel command systems such as on Ranger, was derived for the purpose of solving the problem of loss-of-lock estimation of error and erasure probabilities for an out-of-lock indicator channel. The present bivariate test is not distribution free, since a transformation must first be performed which depends on the alleged distribution. The transformations are simple enough, however, to make the test useful in bivariate extreme-value theory. L.S.

N67-12148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATION SYSTEMS DEVELOPMENT: PROBABILITY DISTRIBUTIONS AND ERROR RATES IN SPACECRAFT RECEIVERS
W. Lindsey *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 230–235 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The probability distribution of the phase error of a Mariner type of communication system in which two channels are employed in the transmission of command data to the spacecraft, is presented and used for specifying the differenced-correlator output statistics and performance of the receiver. One channel of the communication system is used to convey the command data, and the second channel is used to convey timing information for operation of the cross correlators, viz., bit sync and subcarrier phase sync. The probability distribution is easily measured in the laboratory, thus saving time over that provided by the method of extreme-value statistics. The problem of specifying the probability that a set of cross-correlators will err in making a decision is also considered. A conditional error probability method was used to solve the problem. L.S.

N67-12151* National Aeronautics and Space Administration, Washington, D. C.
OBSERVATION OF THE RUSSIAN MOON PROBE "LUNA 10" [BEOBACHTUNG DER SOWJETISCHEN MONDSONDE "LUNA 10"]
H. Kaminski Nov. 1966 9 p refs Transl. into ENGLISH from Raumfahrtforsch. (Stuttgart), no. 3, 1966
(NASA-TT-F-10603) CFSTI: HC $1.00/MF $0.50 CSCL 09F

Objectives and background information on the Luna X are summarized, and obeservational procedures are described. Using a 20-m parabolic antenna, Luna X transmissions were received on a frequency of 183.635 Mc/s between April 3 and 5, 1966. Telemetry, field intensity, and Doppler effect were received and recorded. The maximum field intensity recorded was around 7 to 8 dB above the noise level. The observational facilities are discussed, and details are given on the receiving installation used. L.E.W.

N67-12158*# Texas Univ., Austin. Electrical Engineering Research Lab.
[PROCUREMENT, OPERATION, AND RELOCATION OF THE 16 FOOT MILLIMETER WAVELENGTH ANTENNA SYSTEM] Final Report, 13 Nov. 1961–13 Nov. 1966
C. W. Tolbert 14 Nov. 1966 7 p refs
(Contract NASr-87)
(NASA-CR-80099) CFSTI: HC $1.00/MF $0.50 CSCL 09F

Operation of a 16-foot millimeter wavelength parabolic reflector antenna is described. The antenna system is maintained as a millimeter wavelength telescope and used in exploring the refraction and propagation characteristics of the Earth's atmosphere between frequencies of 22.3 Gc and 325 Gc. A list of publications resulting from investigations with the antenna system is included. S.P.

N67-12243*# Consultants and Designers, Inc., Arlington, Va.
ON CERTAIN REGULARITIES IN THE FORMATION OF INHOMOGENEITIES IN THE IONOSPHERE AND THEIR RELATIONSHIP WITH PARTICLE RUN-OUT FROM OUTER SPACE [O NEKOTORYKH ZAKONOMERNOSTYAKH V OBRAZOVANII NEODNORODNOSTEY V IONOSFERE]
A. A. Bol'shoy 26 Aug. 1966 10 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 4, no. 4, 1966 p 568–573
(Contract NAS5-9299)
(NASA-CR-80168; ST-AI-RWP-10510) CFSTI: HC $1.00/MF $0.50 CSCL 20N

As a result of the work performed, it was corroborated that the dissection ("scintillation") of radiosignals emitted from cosmic objects is explained by radiowave diffraction on the inhomogeneities of the ionosphere. The frequency of radioscintillation appearance depends on the latitude of location of the cosmic object and the time of the day. A relationship is ascertained between the appearance of scintillation and the phenomena of washed out reflections from the F-layer of the ionosphere. On the other hand, a connection is established between the particle "run-out" phenomenon and the scintillation of radiosignals from AED and other cosmic objects, that is with the presence of inhomogeneities in the ionosphere. The conclusion is derived that the origin of ionosphere inhomogeneities may be explained by particle "run-out" from outer space, this being at least one of inhomogeneities factors inducing them. Author

N67-12270*# Smith Electronics, Inc., Cleveland, Ohio.
STUDY OF SHORT TERM PHASE STABILITY Interim Report, 16 Mar. 1964–16 Mar. 1965
Huntsville, Ala., NASA. Marshall Space Flight Center, 16 Mar. 1965 57 p refs
(Contract NAS8-11592)
(NASA-CR-80091) CFSTI: HC $3.00/MF $0.50 CSCL 09D

Theoretical and experimental work in the area of frequency division is reported. It is shown that true frequency division is a rarity because of the requirement for storage capability. Examination of various models indicates that signal-to-noise enhancement by the frequency division operation per se is not possible. Experimental subharmonic generation with step-recovery diodes is reported. A survey of types of parametric amplifiers is presented and experimental work with tunnel diodes as L- and S-band downconverters described. It is concluded that noise figure results comparable to or slightly better than high quality crystal diodes are achievable with an advantage in low L.O. power requirement. A review of the theory of one approach to phase stability is included. Author

N67-12277*# Kansas Univ., Lawrence. Center for Research Inc.
IONOSPHERIC EFFECTS ON 400 Mc RADAR SIGNALS
H. Unz [1965] 27 p refs
(Contract NSR-17-004-003)
(NASA-CR-80194; CRES-61-15) CFSTI: HC $2.00/MF $0.50 CSCL 09F

The effects of the ionosphere on 400 Mc radar signals sent vertically downward from a satellite at the height of 300 km have been investigated. The time delay and the virtual height, the attenuation factor, and the Faraday rotation have been calculated. Author

N67-12286# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
WAVEGUIDE, WAVEGUIDE CIRCUITS AND ANTENNA RESEARCH STUDY Quarterly Progress Report, 1 Jun.–31 Aug. 1966
Elmer H. Schelbe 30 Sep. 1966 20 p refs
(Contract DA-36-039-AMC-02261(E))
(QPR-4; AD-633243) CFSTI: HC $2.00/MF $0.50

A study of the measuring system was made using a Hewlett-Packard 851A/8551A Spectrum Analyzer. It was found that under certain conditions a high frequency modulation was present in the output of the stabilized klystron and further that the Dymec stabilizer often locked onto one of the modulation side bands. The largest single loss within the beam waveguide resonator was due to the coupling holes. When the coupling hole loss was accounted for, using an analysis by McCumber, the measured and predicted Q of the beam waveguide resonator operating at 35 GHz were in reasonable agreement. The additional measurements made on the parallel plane resonator indicated that the coupling

hole loss was also an important factor in determining the Q. The coupling hole loss cannot be accounted for in the case of the parallel plane resonator since the field distribution within the resonator is not known. It also appears that the Q of the parallel plane resonator depends on the diameter of the end plates. Author (TAB)

N67-12292# University Coll., London (England). Phonetics Lab.
[VOWEL STUDY] Progress Report
A. J. Fourcin, ed. Sep. 1965 77 p
(Contract AF 61(052)-692)
(AFCRL-66-169; AD-633350) CFSTI: HC $3.00/MF $0.75

Contents: Duration and spectral form as cues in the recognition of English and German vowels; perception of time intervals; pitch mediation by temporal mechanisms; experiments with delayed auditory feedback; formants in Vietnamese vowels of different tones; measurement of trans-glottal impedance; fricative synthesis with an acoustic model; spectral analysis; direct random recording of synthetic speech stimuli; automatic audiometer; dependence of stress judgments on vowel formant structure. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N67-11242*# International Business Machines Corp., Yorktown Heights, N. Y.
PROGRAM DOCUMENTATION FOR A SELECTIVE DISSEMINATION SYSTEM FOR NASA SCIENTIFIC AND TECHNICAL INFORMATION
Jun. 1966 226 p
(Contract NASW-695)
(NASA-CR-62021) CFSTI: HC $3.75/MF $1.25 09B

Record formats, operating instructions, and flow charts are presented for a selective dissemination of information (SDI) program requiring an IBM 7090/94 computer with 32K storage, two IBM 7607 data channels, and at least eight IBM 729 tape drives. Three component programs are documented: (1) vocabulary control (VOCON), which updates the dictionary and user interest profiles and edits document indexes and user profiles against the dictionary; (2) profile matching (MATCH), which compares document indexes with user profiles and generates announcements when match criteria are met; and (3) user response posting (POST). The programs run under modified versions of the Fortran II Monitor System and in general are written in FAP. Author

N67-11305# Mitre Corp., Bedford, Mass.
USER'S DESCRIPTION OF THE DD-13 DISPLAY CONSOLE CONNECTED TO PHOENIX
Jonathan Mitchell Bedford, Mass., AFSC, Electron. Systems Div., Jul. 1966 43 p ref
(Contract AF 19(628)-5165)
(MTR-175; ESD-TR-66-104; AD-639167) CFSTI: HC $2.00/MF $0.50

The report describes the dd-13 display console, as it will be connected to the PHOENIX computer for the benefit of prospective users. Author (TAB)

N67-11343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN AUTO-DIAGRAMMER
G. Hain and K. Hain Washington, NASA, Nov. 1966 23 p ref
(NASA-TM-X-1317) CFSTI: HC $1.00/MF $0.50 CSCL 09B

A program called Auto-Diagrammer is described in this paper. Using the plotter feature of the SC 4020 computer, the program automatically draws flowcharts from PERT or LOGIC data card inputs, or directly from Fortran II, Fortran IV, and FAP source decks, without the need of providing extra control cards. The Auto-Diagrammer can handle up to 1500 elements and up to 4000 connections between them. The program also contains the facility to extract logical details or contract flowcharts to show the over-all logical details or contract flowcharts to show the over-all logical structure of a network more clearly. In addition, large networks can be broken up into smaller ones with up to 200 elements, with indications of the interfaces. The Auto-Diagrammer itself is written mainly in Fortran and partly in FAP. This paper describes briefly the logical structure of the program, then gives operating instructions with detailed examples. Author

N67-11344*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
REVISED THREE DEGREE OF FREEDOM PARTICLE TRAJECTORY PROGRAM CODE FOR THE IBM 7094 COMPUTER
Wilber R. Boykin Washington, NASA, Oct. 1966 211 p refs
(NASA-TN-D-3463) CFSTI: HC $3.75/MF $1.25 CSCL 09B

This IBM 7094 computer program simulates the motion of a spacecraft by the numerical integration of its spherical polar equations of motion; the spacecraft is represented as a point mass subjected to aerodynamic and thrust forces near an oblate, rotating earth. The program is written primarily in absolute FAP, but also it contains some relocatable FAP and Fortran II subroutines. It can be run either under or independently of the Fortran II monitor system. Author

N67-11704# Martin Co., Baltimore, Md.
ORBIT DETERMINATION AND EPHEMERIS COMPUTATION. DIGITAL COMPUTER PROGRAM Interim Scientific Report, 1 Jun. 1965–31 May 1966
Karlis Minks, Jacques Fein, and Bruce E. Clemenz May 1966 150 p refs
(Contract AF 19(628)-4167)
(ER-13950; AFCRL-66-259; AD-637206) CFSTI: HC $4.00/MF $1.00

The program is based on the analytical work contained in a previous report (AD-625 453). In addition, some analytical methods not covered in the above report are presented in the appendix of this report. The operating modes, general features and accuracy of the program are discussed, operating instructions and input/output descriptions and definitions are provided. All symbols used in the program are listed and defined. Flow charts, descriptions and explanations of the program and subroutines are also included. The program is written in Fortran IV and machine language (MAP). Double precision is used extensively. Author (TAB)

N67-11757# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SOME TESTING METHODS FOR RANDOM GENERATORS [EINIGE TESTMETHODEN FUER ZUFALLSGENERATOREN]
Rudolf Gorenflo and Maria Grazia Pacco Jan. 1966 86 p refs
In GERMAN; ENGLISH summary
(IPP-6/47) CFSTI: HC $3.00/MF $0.75

A few test methods for random generators and the results of applying them to a few pseudo-random generators are described. The generators investigated are used in simulating physical stochastic processes and testing the stability of numerical methods on an IBM 7090. Author

N67-11896# Northwestern Univ., Evanston, Ill. Technological Inst.
ON A SPECIAL CLASS OF CONSTRAINED GENERALIZED MEDIAN PROBLEMS

A. Charnes, M. J. L. Kirby (Chicago Univ.), and W. M. Raike April 1966 22 p refs /ts Res. Memo. 155
(Contracts Nonr-1228(10); DA-31-124-ARO(D)-322)
(AD-639465) CFSTI: HC $1.00/MF $0.50

By means of elementary properties of the absolute value function, important properties of a special class of 'constrained generalized median' problems (and eventually, the most general class, vide Charnes, Cooper, Thompson) such as existence of solutions, gradient and incremented formulae, linear programming and probabilistic interpretations are obtained for all classes of joint distribution functions for which the problems make sense. Results of A. C. Williams and R. Wets obtained by involved arguments and sophisticated constructs appear, when corrected, as special instances of some of the above results but devoid of the interrelations and interpretations adduced. (Author) TAB

N67-11978# European Atomic Energy Community, Ispra (Italy). Technology Engineering Dept.
REVERSIBLE DECIMAL COUNTERS [CONTATORI DECIMALI REVERSIBILI]
G. Battistelli Aug. 1966 14 p refs In ITALIAN; ENGLISH summary
(EUR-3062.i) CFSTI: HC $1.00/MF $0.50

A general analysis of a decimal scaler obtained from four binaries controlled by logic gates is described. The method to find the boolean equations that determine their behavior is shown. Some types of reversible counters developed in the electronic laboratory are compared with regard to cost and number of components. Author

N67-12023# Library of Congress, Washington, D. C. Aerospace Technology Div.
ELECTRICAL AND COMPUTER SYSTEMS Surveys of Foreign Scientific and Technical Literature, 1964–1965
15 Jun. 1966 151 p refs Compilation of Abstracts
(ATD-66-72)

An annotated bibliography of Soviet electrical and computer systems technology is reported. Included are abstracts and translations of articles in the following areas: hydraulic computer elements (fluid to electrical interface devices); microelectronics; and communications and coding techniques. S.C.W.

N67-12028# Library of Congress, Washington, D. C. Aerospace Technology Div.
ANALOG COMPUTER FOR ANALYZING ELECTROENCEPHALOGRAMS Translations of Foreign Scientific and Technical Literature
Daniel Wolkonsky 2 Sep. 1966 7 p refs
(ATD-66-109)

An automatic device for the continuous computation of the ratio between the frequency and intensity of electroencephalogram (EEG) oscillations is described. The analog computer consists of an I-f meter, an RMS voltage meter, a ratio calculator, and a recorder. Measurement error does not exceed 5%. Electroencephalograms of rabbits and humans were studied under various experimental conditions (in a state of rest, under the action of stimuli, etc.). A graph was generated which illustrates the frequency to intensity ratio in the process of desynchronization with a light stimulus. Two phases of desynchronization which corresponded to a considerable increase in frequency to intensity ratio were depicted. The proposed automatic analog computer may be used in experimental and clinical electroencephalography for studies of both background EEG and changes caused by various stimulants and drugs. S.C.W.

N67-12068*# General Dynamics/Convair, San Diego, Calif. Space Sciences Lab.
INVISCID ANALYSIS OF THE PLUME CREATED BY MULTIPLE ROCKET ENGINES. PART II: DESCRIPTION OF THE COMPUTER PROGRAMS
L. D'Attorre, G. Novak, H. U. Thommen and V. L. Trammell May 1966 121 p
(Contract NAS8-20101)
(NASA-CR-79741; GD/C-DBE-66-014) CFSTI: HC $4.00/MF $0.75 CSCL 09B

The computer programs for the calculation of the single jet and the five jet interaction regimes are discussed in detail. Input and running instructions are given and coarse grained flow charts are presented. Complete listings of the programs are also given. The program for the two jet interaction problem is discussed only as it deviates from the five jet program. Author

N67-12088# Joint Publications Research Service, Washington, D. C.
ANALOG AND DIGITAL COMPUTER REQUIREMENTS IN THE USSR
B. Volynskiy and V. Bukhman 14 Nov. 1966 4 p Transl. into ENGLISH from Pravda (Moscow), 5 Oct. 1966 p 3
(JPRS-38629; TT-66-35054) CFSTI: $1.00

The general development and the functions of computers are briefly discussed. Capacity, accuracy, and cost of digital and analog computers are compared. It is pointed out that the development of analog computers has been neglected in the Soviet Union, and the practicality of such a development is stressed. K.W.

N67-12088# Joint Publications Research Service, Washington, D. C.
ELECTRONIC DIGITAL COMPUTERS OF THE ZAM SERIES
T. Pietrzykowski 30 Nov. 1966 9 p Transl. into ENGLISH of an article from the book "Sredstva i Metody Mekhanizatsii Podgotovki i Poiska Nauchno-Tekhnicheskoy Informatsii, Inzhenernogo i Upravlencheskogo Truda" Moscow, 1965 p 159–166
(JPRS-38889; TT-66-35313) CFSTI: $1.00

This series, developed and manufactured in Poland, consists of five different digital computers. Logic structure, programming system, and method of operation are the same for all types. All machines use the binary numbering system. The fundamental work length is 24 bits. The ferrite memory system in the machines consists of standard, blocks containing 4096 or 8192 words. Normal maximum capacity of the memory is 32,768 words; under special conditions the capacity is 262,144 words. All machines in the series use a unified static germanium technique in which the pulse rise time is 0.4 microseconds. Characteristics of the five models are listed, and the unified programming system for the computers is discussed. K.W.

N67-12155*# Oak Ridge National Lab., Tenn. Neutron Physics Div.
SIGNIFICANCE ARITHMETRIC FOR FORTRAN
W. R. Burrus and B. W. Rust 4 Nov. 1966 31 p refs
(NASA Order R-104(01))
(NASA-CR-80095; ORNL-TM-1249) CFSTI: HC $2.00/MF $0.50 CSCL 09B

The Fortran statement X # 193./71.-2721./1001. has a true value of 0.0000281409... but a single-precision Fortran computation (27 bit fraction) yields 0.28133392E-04 (using an E14.8 output FORMAT) due to loss of significance when subtracting. When the number of significant digits is questionable, the same problem may be run in both single and double precision. This is inconvenient because existing programs must be modified and because double precision requires twice as much storage space. We have implemented a simple alternative due to Max Goldstein for keeping track of the amount of significance in floating-point numbers by representing them in unnormalized form. Programs may be written in ordinary Fortran-IV, and the significance operations implemented by use of the ALTER feature of the loader. Some problems and applications of significance arithmetic are discussed. Author

N67-12160*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
FORTRAN PACKAGE FOR LEAST SQUARES CURVE FITTING AND THE SOLUTION OF SIMULTANEOUS EQUATIONS
J. G. Hust and R. D. Mc Carty 10 Oct. 1966 18 p refs
(NASA Order R-45)
(NASA-CR-80100; NBS-9258) CFSTI: HC $1.00/MF $0.50
CSCL 09B

Fortran subroutines are described for the solution of a least squares problem. Three subroutines are listed which establish the normal equations, constrain the normal equation, and perform matrix inversion by the Gauss-Jordan method. The latter subroutine may also be used for the simultaneous solution of any set of linear equations. Author

N67-12167*# Bellcomm, Inc., Washington, D. C.
PROCEDURES FOR MANAGEMENT CONTROL OF COMPUTER PROGRAMMING IN APOLLO
B. H. Liebowitz, C. S. Sherrard, and E. B. Parker, III 28 Sep. 1966 206 p refs
(Contract NASw-417)
(NASA-CR-80132; TR-66-320-2) CFSTI: HC $6.00/MF $1.25
CSCL 09B

Formal techniques for management control are required to ensure the production and delivery of working, usable computer programs. A set of techniques, which are general enough to be applied across the variety of computer programming tasks found in the Apollo Project, are set forth in this report. Because most of the large, mission-critical computer programs in Apollo are developed by outside contractors, various aspects of the user-contractor relationship are given particular attention. Author

N67-12199# Naval Ordnance Test Station, China Lake, Calif.
PRINCIPLES AND PROCEDURES FOR THE AUTOMATED FLOW CHARTING PROGRAM FLOW 2
W. B. Stelwagon Aug. 1966 67 p refs
(NOTS-TP-4095; AD-637863) CFSTI: HC $3.00/MF $0.75

Principles and procedures are described for the automatic flow-charting program FLOW2, developed for use with the IBM 7090 or 7094 computer to produce flow charts from the source decks of FORTRAN II, FORTRAN IV, or FORMAC programs or from special input decks. Program output is a magnetic tape for use with a General Dynamics SC-4020 plotter, or output may be punched cards by which a flow chart may be reproduced and modified according to the user's needs. Problems of block content, of block positioning, and of the routing of flow lines are discussed in the report proper, with more detailed procedures given in two appendixes. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N67-11236# Bunker-Ramo Corp., Canoga Park, Calif. Defense Systems Div.
PLANAR COAXIAL INTERCONNECTION TECHNIQUES
Quarterly Report, 1 Apr.-30 Jun. 1966
Howard L. Parks, Charles W. Smith, and Robert B. Older Sep. 1966 41 p
(Contract DA-28-043-AMC-02024(E))
(QR-1; Rept.-1; F-058; ECOM-02024-1; AD-639068) CFSTI: HC $2.00/MF $0.50

The object of this work is the development of planar coaxial interconnection techniques that integrate the batch fabrication advantages of printed circuits with the electrical characteristics of point-to-point coaxial wiring by forming coaxial conductors within laminated aluminum plates. Analyses and investigations have been completed on three types of aluminum, eight types of surface preparation, and two types of photo resist; in addition, several combinations of etch solutions and etch times have been studied. Work to date indicates that the aluminum surface can be prepared by mechanical sanding, followed by trichloroethylene vapor cleaning; with this approach, Kodak KMER or KPR is used as the photo resist, 22 degree Baume ferric chloride is used as the etchant, and alloy 1100 aluminum is used as the substrate. An alignment tool, for punching holes in photographic film masks and the aluminum plates to an accuracy of 0.0001 inch, has been fabricated and is being investigated. Results obtained indicate that channels can be etched into aluminum plates with depths controlled to an accuracy of 0.5 mil, that cavity widths can be etched to within plus or minus 1.0 mil, and that the etched channel linearity can be held to within plus or minus 0.3 mil. Preliminary analysis indicates that coaxial lines fabricated into the planar coaxial planes on 0.025-inch centers will provide characteristic impedances and tolerances consistent with the objectives of the program. Author (TAB)

N67-11238# Naval Ammunition Depot, Crane, Ind.
μ-NOTES NO. 17—INFORMATION ON MICROELECTRONICS FOR NAVY EQUIPMENTS
30 Sep. 1966 86 p refs
(AD-639091) CFSTI: HC $3.00/MF $0.75

Contents: Epitaxial studies (Part VII); Microelectronic power supply program; Evaluation of Westinghouse family DTL 200; Evaluation of ITT DTL MIC 900 series; Evaluation of radiation family DTL 200; Evaluation of sprague modules UC 6007C, UC 6008C, UC 6009C. TAB

N67-11250# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
TRANSISTOR QUALITY STATISTICS IN A PULSED IONIZING RADIATION ENVIRONMENT-T_{sR} Final Report
K. R. Walker, E. C. Smith, R. I. Wilbur, and E. A. Carr Sep. 1966 84 p refs
(Contract N228(62479)69539)
(FR-66-17-158; USNRDL-TRC-58; AD-638862) CFSTI: HC $3.00/MF $0.75

A statistical study was performed to establish prediction probability levels for the Hughes radiation-induced storage time (t sub sR) prediction technique as applied to worst-case circuit design and transistor quality control. One hundred ten (110) each of five (5) transistor types were employed in the study. The study shows that it is feasible to use this prediction technique to estimate the mean and upper spread limits of open-base radiation storage time, sub sR*, for individual device types. Hence, the technique can be employed in worst-case design procedures, in quality control and in device type selection. A procedure is given for predicting a t sub sR* distribution, for a large transistor batch, form the measured high-current electrical storage (t sub s) distribution and statistical parameters obtained from small sample (e.g., 10 - 15 units) radiation measurements. According to standard statistical tests, the distribution predictions exhibit high confidence (90 - 95%) for radiation rates significantly greater than that required for marginal saturation. Additionally, a nomograph prediction method is presented which provides estimates of t sub sR* means and spread limits based completely upon electrical measurements. (Author) TAB

N67-11292# Army Electronics Labs., Fort Monmouth, N. J.
MICROWAVE SEMICONDUCTOR OSCILLATOR AND AMPLIFIER

Vincent J. Higgins, Frank A. Brand, and Joseph J. Baranowski Aug. 1966 31 p refs
(ECOM-2738; AD-638729) CFSTI: HC $2.00/MF $0.50

P-N junction diodes, both silicon and gallium arsenide, oscillate at microwave frequencies when reverse biased into avalanche. Principal mechanism of oscillation is the creation of a dynamic ac negative resistance through avalanche transit time effects. This report presents details on the performance characteristics of p-n junction avalanche oscillators including description of a signal substitution measurement technique. This technique permits accurate measurement of closely spaced by distinct oscillations without the use of filters and is used to detect, observe, and characterize avalanche oscillation in the frequency range 6 - 50 GHz. Details of experimental results on CW and pulsed oscillations, including rf outputs, dc to rf efficiency, tunability, stability, and parametric effects are given for GaAs oscillators. Comparative oscillation performance of some silicon avalanche oscillators is also given. In addition, details of recent avalanche amplifier investigations are presented. Principal highlights of these avalanche devices are oscillation outputs of over 25 mW at 13 GHz with 5.7% efficiency, 1000 MHz tunable bandwidths for 2:1 power changes; amplifiers are 44 db gain at -60 dbm, and 12 db gain at 0 dbm in the 12 - 15 GHz frequency range. Author (TAB)

N67-11316# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ACTIVE AND PASSIVE BAND-PASS FILTERS WITH LINEAR PHASE
Gerald F. Allsman Jun. 1966 64 p refs
(GGC/EE/66-1; AD-639577) CFSTI: HC $3.00/MF $0.75

A new type of pole-residue, linear phase, band-pass filter, originally presented by Robert Larner in 1964, is analyzed, its method extended, and suggested improvements given. A different method of describing the filter parameters is given and equations are developed that allow a wide latitude in adjusting the system gain and pole locations to achieve desired in-band magnitude and magnitude ripple relationships. A quantitative comparison of the filter is made with the Chebyshev, Butterworth, and Thomson filters. Suggested unbalanced network realizations are given using Negative Impedance Converters and Tunnel Diodes.
Author (TAB)

N67-11370*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NANOSECOND PULSE LOW-POWER AMPLITUDE-TO-TIME CONVERTER AND ASSOCIATED LINEAR GATE CIRCUITS
Norman M. Garrahan July 1966 18 p
(NASA-TM-X-55592; X-711-66-330) CFSTI: HC $1.00/MF $0.50 CSCL 09C

During the development of a pulse height analyzer for nanosecond pulses produced by satellite and balloon-borne cosmic ray detectors, a need arose for both a low-power pulse-gating circuit and an amplitude-to-time converter. It was required that each device respond to pulses as short as 200 nanoseconds. In addition, linear operating characteristics were needed over a range of input pulse amplitudes from 10 millivolts to 5.12 volts. Subsequent effort produced a circuit that met these requirements, and it is believed that the achievement represents a sufficient advance over existing state of the art to warrant a brief report on its configuration and operation. Author

N67-11373*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTS OF SPACE RADIATION ON MOSFET DEVICES AND SOME APPLICATION IMPLICATIONS OF THOSE EFFECTS
Frederick Gordon, Jr. and Harry E. Wannemacher, Jr. Aug. 1966 36 p refs
(NASA-TM-X-55597; X-716-66-347) CFSTI: HC $2.00/MF $0.50 CSCL 09E

The initial tests were run using Co 60, and gamma and 2 Mev electrons. An additional set of experiments was directed toward microcircuits. The results of the tests seem to indicate the MOSFET devices can be used in spacecraft applications with proper shielding. Because of the space-weight-power savings made possible by the use of these devices, this additional shielding can be tolerated. Charts which summarize the data obtained during the tests are included. H.S.W.

N67-11682*# Smith Electronics, Inc., Cleveland, Ohio.
STUDY OF SHORT TERM PHASE STABILITY. AN EXPERIMENTAL COHERENT FRACTIONAL FREQUENCY MULTIPLIER FOR S-BAND
Robert A. Mostrom [1965] 24 p refs
(Contract NAS8-11592)
(NASA-CR-79528) CFSTI: HC $1.00/MF $0.50 CSCL 09C

Development of an experimental fractional frequency multiplier achieving coherence through harmonic and subharmonic operations is described. Step-recovery diodes are used in high order, high efficiency frequency changing circuits, operating between S-band and VHF frequencies. No frequency mixing operations are required, eliminating the need for stable local oscillators. The complete unit operates on an input of 2101.8 MHz and delivers 2282.5 MHz. Measurements of bandwidth, coherence and phase stability are described. Author

N67-11855 Auburn Univ., Ala. Dept. of Physics.
BREAKDOWN IN VACUUM DEPOSITED THIN FILM SILICON MONOXIDE CAPACITORS Supplement to Final Report
Paul J. Hayes (Ph.D. Thesis) Aug. 1966 165 p refs
(Contract NAS8-11279)
(NASA-CR-79925) CFSTI: HC $5.00/MF $1.00 CSCL 09A

A technique is developed by which thin film silicon monoxide capacitors are vacuum deposited and subsequently removed from the substrate intact, thus permitting electron microscope study of the capacitors while under electrical stress. Breakdown center defects of about one-half micron diameter were noted. It was established that during breakdown the silicon monoxide decomposes, leaving free crystalline silicon. Several breakdown patterns were observed in the electron microscope. Single breakdowns exhibit either a strong radial or concentric pattern, or both. The breakdown strength was found to be relatively independent of temperature. Also studied was the rate of breakdown as the voltage across a capacitor is steadily increased to and above the voltage corresponding to the breakdown strength. Additional observations were made regarding pulse characteristics, and optical photomicrographic examination of the breakdowns is discussed. K.W.

N67-11961# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
STANDARD RELAY MODULES FOR SAFETY AND CONTROL CIRCUITS. PART 2: INSTRUCTION AND MAINTENANCE MANUAL
B. J. Maple and A. G. Cooper 1966 66 p
(TRG-933(R), Pt. 2) HMSO: 9s

Standard relay modules have been designed to meet the need for relay logic in an experimental plant. The design can be constructed without prior knowledge of the plant requirements and can be made to suit a particular application by the simple expedient of arranging links in a removable connector. Author

N67-11883# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass.
DESIGN MODIFICATION AND CONSTRUCTION OF HIGH POWER DEUTERIUM THYRATRONS, PHASE 2 Final Report
Nicholas Reinhardt Sep. 1966 13 p
(Contract NObsr-89405)
(B-3419; AD-639357) CFSTI: HC $1.00/MF $0.50

In the design and development of a miniaturized, ruggedized tube with better life characteristics, warm-up time was reduced to a stable 600 seconds maximum through further refinement of the cathode structure. By decreasing the amount of electrical shielding to provide a low, stable emission drop and shorter tad, cathode area utilization and emission were improved. Time of anode delay was also reduced. N.A.S.

N67-11885# General Electric Co., Syracuse, N. Y. Electronics Lab.
ANALYSIS OF THE IMAGE DISSECTICON IMAGE
M. Namordi Jul. 1966 55 p refs
(Contract N123(62738)54130A(X))
(AD-639067) CFSTI: HC $3.00/MF $0.50

A new type of low-light-level image tube called the image dissecticon is briefly described. In order to attain a better understanding of its operation and performance, a critical examination of the tube's constituent parts is made. The minimum level of detection as well as the performance of the dissecticon with an ideal disperser is determined. Finally, image dissecticon performance is characterized in terms of the disperser characteristics. These relationships are then used to determine dissecticon performance for specific types of dispersers. Although this analysis is concerned solely with the image dissecticon, it is readily applicable to the performance determination of other low-light-level image devices Author (TAB)

N67-11894# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
PRODUCTION ENGINEERING MEASURE FOR SILICON OVERLAY TRANSISTORS Quarterly Progress Report, 1 Jan.–31 Mar. 1966
Michael Cassidy and Paul Greer Apr. 1966 45 p
(Contract DA-36-039-AMC-06156(E))
(QPR-5; AD-635118) CFSTI: HC $2.00/MF $0.50

The following process steps are described: scribing, die breaking, die bonding, wire bonding, deionized water boil and bake, cascade rinse, bake, and weld. The efforts expended by the reliability program department were in the areas of test performance, electrical parameter measurements, data analysis, and preparation of the 2N2369 specification and quality control plan. Author

N67-11895# Piezo Crystal Co., Carlisle, Pa.
PEM QUARTZ CRYSTAL UNITS, FILTER LOW FREQUENCY, 1 MC TO 10 MC TYPES CR-(XM-49)/U THRU CR-(XM-52)/U Quarterly Progress Report, Apr.–Jun. 1966
A. S. Matistic 30 Aug. 1966 19 p
(Contract DA-36-039-AMC-03635(E))
(APR-8; AD-639100) CFSTI: HC $1.00/MF $0.50

Conclusions: Techniques and processes, which were successfully applied in fabricating the preproduction samples, are adequate for the production run. Successive crystal fabrication—in prior development effort and for reproduction samples—produced results which are substantially identical. The rejection rate is greater for the unwanted mode test than for all remaining tests combined; unwanted mode rejects range from 0% at 1.75 Mc to 50% at 5 Mc. Similar results are anticipated for the production run. Author (TAB)

N67-11901# United Kingdom Atomic Energy Authority, Harwell (England). Research Group.
A COMPACT ELECTRONIC UNIT FOR USE WITH SCINTILLATION DETECTORS (THE HARWELL 2000 SERIES TYPE 2179)
J. Pickup and G. F. Snelling Jul. 1966 40 p refs
(AERE-R-5225) HMSO: 5s 6d

A relatively inexpensive electronic unit is described that is suitable for many applications specific to the use of NaI scintillation counters and that can be used in cases where great experimental flexibility is not a requirement. This unit does not require an amplifier adjacent to the detector, but instead has direct coupling to a standard scintillation detector housing via a single coaxial cable whose length is not a critical factor. Analog and digital outputs are available to enable both pulse amplitude analysis and total counting. Specifications for the unit are detailed, along with its performance features. Differences in photomultiplier characteristics are discussed, and the derivation of the photomultiplier EHT voltage required to produce a specified input charge per pulse is included. M.W.R.

N67-11923# Piezo Technology, Inc., Orlando, Fla.
PEM FOR FILTERS, UPPER SIDEBAND (1.75 Mc) QUARTZ CRYSTAL FILTERS TYPE EL-FRCX-1) Quarterly Progress Report, 1 Jan.–30 Jun. 1966
I. W. Callahan 30 Jun. 1966 27 p
(Contract DA-36-039-AMC-03636(E))
(PQR-5; AD-639431) CFSTI: HC $2.00/MF $0.50

Progress in the manufacture of upper sideband (1.75Mc) quartz crystal filters is reported. Spurious response requirements are discussed, and preproduction test procedures are described. Results are presented for terminal strength, sealing, stability at temperature extreme, vibration, shock, thermal shock, immersion, and moisture resistance studies. A.G.O.

N67-11932# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
MEASUREMENTS OF NONLINEARITIES IN A TRAVELING WAVE TUBE
J. I. Lindstroem 1 Jun. 1966 31 p refs
(Contract AF 61(052)-594)
(RADC-TR-66-563; RR-65; TN-12; AD-638195) CFSTI: HC $2.00/MF $0.50

Measurements of the nonlinear amplitude distortion and phase shift in a TWT are reported. The test object is a commercial 1 W, S-band, O-type TWT with a helical slow wave structure. An extensive set of output amplitude and phase data were recorded for a wide range of input powers and helix voltages. The results are in good qualitative agreement with a recent nonlinear field theory developed by Nilsson. The best helix voltage settings in order to obtain minimum distortion in amplitude and phase respectively are located on opposite sides of the voltage that gives maximum small signal gain. This fact, which is theoretically well founded, is a complication in such applications where demanding specifications concerning amplitude and phase linearity must be met simultaneously. The measured nonlinearities are about three or four times larger than theoretical predictions. This discrepancy deserves a thorough investigation since it indicates that there is a margin for improving the tube design from the distortion point of view. (Author) TAB

N67-11967*# Librascope, Inc., Glendale, Calif. Reliability Dept.
STUDY OF FAILURE AND RELIABILITY IN MICROELECTRONIC DEVICES Quarterly Report
30 Nov. 1965 48 p
(Contract NAS12-72)
(NASA-CR-77141; Rept.-2-0412; QR-1) CFSTI: HC $4.00/MF $0.75 CSCL 09A

Efforts to determine failure mechanisms in microelectronic devices and provide methods of detection through testing are reported. Since the majority of the failures involved aluminum and oxide defects, it was concluded that vendors to improve this area through process improvements and tighter inspection standards be considered. It was also concluded that small area gold aluminum thermocompression wedge bonds over oxide were questionable for highly reliable integrated circuits. Findings of temperature cycle and temperature step stress tests are summarized. S.P.

N67-12100# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
METHODS OF REDUCING VEHICLE WIRING WEIGHT AND OF USING FLAT ELECTRICAL CABLE
W. J. Barnett Feb. 1966 110 p refs
(SM-52330)

Flat wire and improved round wire technologies were researched and documented. A variety of flat cable installations were evaluated in an electronic rack with sliding chassis and a hinged panel. Two models of a vehicle junction box were developed to evaluate a weight and cost reduction technique. The information gained from these evaluations and a report on a specialized application of flat cable as an interconnecting wiring system between rotating units is presented. It is recommended that further development be invested in improved round wire systems for wiring system weight reduction. Author

N67-12113*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ACCELERATED LIFE TESTING OF TRANSISTORS
E. Klippenstein *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 36 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The basic problems associated with normal life testing of transistors are listed in conjunction with a program designed to study the techniques of accelerated testing and to determine the acceleration obtained by both incremental increases in stress and high constant stresses. The applied stress is the temperature at the collector-base junction; optimum methods for measuring thermal resistance were determined. Two techniques based on the base emitter voltage (VBE) method were investigated in detail using different instrumental setups. Accuracy of the results were compared with those obtained by direct methods, and the VBE technique was found to be the most repeatable and the most accurate. Results indicate that junction temperature can be determined to within ±1.5%. M.G.J.

N67-12114*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT OF WIRECON UTILITY TEST MODULE
E. R. Bunker, Jr. *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 37–40 ref (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Details are given on the development of a Wirecon (wire-connected) electronic module, using cordwood packaging, for use as a standard configuration in testing operation at temperature extremes, evaluating the embedment pressures generated by various encapsulement systems on electronic components, and determining the effects of sterilization. Design objectives are enumerated, and a schematic is included. Figures also depict the jumpers for flip-flop operation, and the interconnection of Wirecon modules. A breadboard, a twice scale module, and a normal scale module were constructed and tested. Findings show that all three modules performed almost identically; variations in the breadboard performance at the higher pulse rates are discussed. M.G.J.

N67-12161*# ITT Federal Labs., Palo Alto, Calif. Semiconductors Product Lab.
HIGH POWER SWITCHING TRANSISTOR Final Report
Richard Finch and Jacques Beaudouin May 1966 49 p ref Prepared for JPL
(Contracts NASA-100; JPL-951156)
(NASA-CR-80141) CFSTI: HC $2.00/MF $0.50 CSCL 09A

The design theory and fabrication procedure is presented for an npn 100 ampere silicon switching transistor. This transistor has a saturation voltage less than 200 millivolts at 75 amperes. This device has several unique features. The base is produced by a "planarized" epitaxial layer. This makes it possible to have a highly doped collector and therefore a relatively high inverse alpha. The metal contacts incorporate a 10 micron electroplated silver layer which allows long narrow emitter fingers. A system of multiple chips in parallel was found to be satisfactory and was used instead of one large chip. This improved the effective yield of the transistor. Author

N67-12189# Lewis (E. B.) Co., Inc., East Hartford, Conn.
PRODUCTION ENGINEERING MEASURE CRYSTAL UNIT CR-(XM-46A)/U Quarterly Report, 1 Feb.–1 May 1966
Ernest B. Lewis 1 May 1966 22 p
(Contract DA-36-039-SC-86737)
(QR-13; AD-639108) CFSTI: HC $1.00/MF $0.50

The plateback technique and its control of spurious responses as used on the preproduction samples is discussed. The data obtained on testing the preproduction samples is presented and the methods of test are discussed. Tests for aging present a problem and its solution by substituting the bridge circuit for the TS-683 test circuit is presented. Author (TAB)

N67-12198# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
PRODUCTION ENGINEERING MEASURE (PEM) FOR TRANSISTOR, PNP, SILICON, SWITCHING TYPE EL-2N(X-12) Fifth Quarterly Report, 25 Mar.–25 Jun. 1966
Larry Lands Aug. 1966 49 p
(Contract DA-36-039-AMC-06160)
(TI-03-66-92; AD-639388)

Manufacturing process specifications were modified or rewritten to allow production of transistor type EL-2N(X-12) on a volume scale. The formalized process was used to fabricate the preproduction samples and to evaluate personnel and equipment requirements for the pilot production run. Pilot line production capability exceeded 200 transistors per 8 hour shift, the specified contract requirement. A quality control manual was prepared to govern the life, environmental, and mechanical tests of the PEM device. Author (TAB)

N67-12230*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIFFERENTIATION CIRCUITS FOR AMPLITUDE-MODULATED SIGNAL ENVELOPES
V. I. Anisimov and Yu. F. Likhodiyevskiy Redstone Arsenal, Ala., Transl. Branch, 16 Aug. 1966 9 p refs Transl. into ENGLISH from Priborostroenie (Moscow), v. 7, no. 5, 1964 p 41–48
(NASA-TM-X-57899) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Two differentiation circuits for amplitude-modulated signal envelopes in which the functions of the modulator and the demodulator are accomplished by one switch are examined. A serious problem arising during the designing of a system with signal modulation is the creation of economic and stable compensation circuits. There are two basic methods of compensation circuits which operate on alternating current. The first method is compensation by sections of alternating current which are different resonance circuits tuned to the carrier frequency. On the strength of this such circuits are extremely critical to changes of the carrier frequency and magnitudes of the self-capacitances, inductances, and resistances. The second method is compensation with double conversion of the signal frequency. Author

N67-12240*# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
DESIGN, DEVELOPMENT AND FABRICATION OF PROTOTYPE SEMICONDUCTOR AMPLIFIERS Final Report, 17 Mar. 1965–16 Mar. 1966
H. C. Chang, N. P. Formigoni, and J. S. Roberts 16 Mar. 1966 141 p refs
(Contract NAS8-11861)
(NASA-CR-80170) CFSTI: HC $4.00/MF $1.00 CSCL 09C

This report covers the fabrication of a high temperature silicon carbide (SiC) integrated circuit using the junction-gate type field-effect transistor (FET) as an active component. The modern photoresist masked-diffusion technique was utilized providing precise control in making the planar device configuration. Aluminum diffusion in SiC requires temperatures from 1800°C to 2100°C. At these temperatures only SiC itself proved effective as a diffusion mask. Device fabrication techniques of high precision necessary for the self-masked diffusion process were investigated. A complete microelectronic process was developed for the fabrication of SiC monolithic planar devices. The fabrication of FET from crystals of medium quality yielded two transistors out of twenty possible devices from three crystals. Author

N67-12258*# Texas Instruments, Inc., Dallas. Semiconductor-Components Div.
DESIGN, DEVELOPMENT AND DELIVERY OF ONE (1) BREADBOARD AND THREE (3) PRODUCTION UNITS OF A 75 VA INTEGRATED STATIC INVERTER Monthly Report No. 15
J. P. Vergez, L. A. Hahn, L. L. Glover, and P. F. Newcomb Jul. 1966 18 p
(Contract NAS8-11925)
(NASA-CR-80088; SC0627-766; MR-15) CFSTI: HC $1.00/MF $0.50 CSCL 09A

Among other technological developments, features designed to alleviate the epitaxial stress problems are reported for a 75 VA integrated static inverter. The design, development, and delivery of one breadboard, and three production units are indicated. The use of thicker oxide growths on emitters is mentioned. In regard to the 16 pin package lid, it is stated that gold-plated Kovar is used for the lid material, and that stitch welding is the method used. Flip-flop arrays, and power transistors are evaluated. Included are an inverter parts list, and a system schematic. R.U.

N67-12300# General Motors Corp., Kokomo, Ind. Delco Radio Div.
PRODUCTION ENGINEERING MEASURE TO IMPROVE PRODUCTION TECHNIQUES AND INCREASE THE RELIABILITY OF THE SCL7004/21 & SCL7004/22 TRANSISTORS Quarterly Progress Report, 30 Nov. 1965–28 Feb. 1966
R. P. Anjard 28 Feb. 1966 35 p
(Contract DA-36-039-AMC-06170(E))
(QPR-1; AD-633783) CFSTI: HC $2.00/MF $0.50

State-of-the-art SCL-7004/21 and SCL-7004/22 samples were supplied; a management plan-Critical Path Plan (Gantt Modified) was submitted and the initial Milestone tests were initiated for SCL-7004/21 type devices. Of the seven process improvements, three are being finalized; one is in the state of continuous improvement, two are being initiated and one is scheduled to start March 1, 1966. During this quarter, the Milestone 1 operating life test was 80% completed and the storage life test 90% completed. The results will be presented in the next quarterly report. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N67-11702# Electronic Associates, Inc., Princeton, N. J. Research and Computation Div.
RESEARCH AND DEVELOPMENT OF ANALOG MODELS Scientific Report, Feb. 15, 1965–Feb. 14, 1966
Richard M. D'Addario 15 Mar. 1966 67 p refs
(Contract AF 19(628)-5043)
(SR-1; AFCRL-66-269; AD-637007) CFSTI: HC $3.00/MF $0.75

In a program of research and development of analog models for Air Force Cambridge Research Laboratories (AFCRL), the contractor has studied methods for establishing analog models for problems submitted by scientists at AFCRL, and implemented them for solution on the AFCRL analog computer. Seven problems were submitted during the past year in the fields of electromagnetic ray propagation, optical physics, chemical reaction dynamics, and neuroelectrical phenomena. Six of the seven simulations gave significant results to the problem initiators. Author (TAB)

N67-11727*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
FUNCTIONAL ANALYSIS OF SYSTEMS CHARACTERIZED BY NONLINEAR DIFFERENTIAL EQUATIONS
Robert Bruce Parente (Ph.D. Thesis) 15 Jul. 1966 115 p refs
(Grants NsG-496; NSF GP-2495; NIH MH-04737-05)
(NASA-CR-79493; TR-444) CFSTI: HC $4.00/MF $0.75 CSCL 09C

Given a nonlinear differential equation, the conditions are shown under which it characterizes an analytic system. Given an analytic system characterized by a nonlinear differential equation, it is shown how that system can be analyzed by an application of functional calculus. Specifically, an inspection technique is developed whereby a Volterra functional power series is obtained for that system's input-output transfer relationship. Applications are given for the demonstration of a pendulum's nonlinear resonance phenomenon; the computation of a shunt-wound motor's response to white noise excitation; the computation of a varactor frequency doubler's transient response; and the determination of the stability of a magnetic suspension device that is now being used in space vehicles. Experimental confirmation of the last stability determination is treated. Author

N67-11728*# Northrop Space Labs., Huntsville, Ala.
SOLUTION OF NONLINEAR ALGEBRAIC EQUATIONS CHARACTERISTIC OF FILTER CIRCUITS Summary Technical Report
Frank B. Tatom, Theodore J. Thomas, and Robert G. Schroeder Sep. 1966 195 p refs *Its* Tech. Memo No. 196
(Contract NAS8-20183)
(NASA-CR-79506; TR-292-8-078) CFSTI: HC $5.00/MF $1.00 CSCL 09C

Discussed is the development of a digital computer program for use in filter circuit analysis problems. The program is designed for obtaining roots to sets of nonlinear algebraic equations characteristic of filter circuits and utilizes a combination of Kizner's method and the Freudenstein–Roth technique. After obtaining the roots, the program selects standard circuit components whose values approximately match the actual roots, determines the transfer function characteristic of the circuit elements selected, and generates frequency response curves for this transfer function. Results of computer runs involving sets of equations in six, thirteen, and fifteen unknowns are discussed. The program is especially suitable to filter circuit analysis problems for which the corresponding set of algebraic equations is not overly ill-conditioned. Extension of the program to algebraic equations in general is discussed. Engineering problems involving simultaneous nonlinear differential equations are presented, based on the idea that efficient numerical processes for simultaneous solving nonlinear algebraic equations may be useful in their numerical solution. Author

N67-11749# Gt. Brit. Ministry of Aviation, London. Technical Information and Library Services.
THE INFLUENCE OF THE CONDUCTOR CONNECTING A NOISE GENERATOR AND A 2-PORT NETWORK DURING NOISE MEASUREMENTS [UEBER DEN EINFLUSS DER VERBINDUNGSLEITUNG ZWISCHEN RAUSCHGENERATOR AND VIERPOL BEI RAUSCHZAHLMESSUNGEN]
M. Pfeiler Aug. 1966 20 p refs Transl. into English from *Ntz-Nachr. Tech. Z. (Brunswich)*, v. 18, no. 9, 1965 p 531–537
(TIL/T-5650) CFSTI: HC $1.00/MF $0.50

For noise measurement generally the network is connected to a calibrated noise generator. If live connection is used the noise factor of the 2-port system is not the true one. The effect of live error is examined and estimated. The term "noise factor" is also discussed, fundamentals in its measurement stated, and a test method described. Author

N67-11829# Joint Publications Research Service, Washington, D. C.
PURSUIT OF CYBERNETICS AND SYSTEMS ANALYSIS URGED
Yu. Filatov and Yuriy Zhuravlev 9 Nov. 1966 7 p Transl. into English from Tekhn. Molodezhi (Moscow), no. 8, 1966 p 1–3
(JPRS-38575; TT-66-35000) CFSTI: $1.00

Excerpts from a news interview about cybernetics are presented. The contribution of cybernetics to present day economy, its use in systems analysis, and its connection with mathematics are mentioned. N.E.N.

N67-11891# Harry Diamond Labs., Washington, D. C.
ELECTROSTATIC FOCUSING OF AN ELECTRON SHEET BEAM IN A SYMMETRIC PLANAR STRUCTURE
B. J. Udelson Aug. 1966 57 p refs
(HDL-TR-1324; AD-639164) CFSTI: HC $3.00/MF $0.75

The relative merits of electrostatically focused electron-sheet beams are evaluated with respect to their use in both O-type and transverse-field devices. Several practical structures for attaining this type of focusing are described. The parameters of interest in a symmetric planar electrostatic-focusing structure--beam perveance, transverse resonant frequency, beam stiffness, and the condition of beam instability--are evaluated analytically as a function of focusing-structure dimensions and applied focusing voltages. The analytic calculations are compared with digital-computer solutions of the paraxial-ray equation as well as with experiment. The beam motion in the unstable region and the electron motions within the beam are also investigated by analog-computer solutions of the paraxial-ray equation. Finally, methods for containing lateral beam spread are discussed Author (TAB)

N67-12133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A DEFINITION OF SYSTEM RELIABILITY
J. F. Meyer *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 154–163 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A measure of system reliability is defined that accounts not only for total success but also for various degrees of partial success which a system might experience in realizing its specified behavior. An analysis is presented on the reliability of a physical system that realizes some specific input–output relation. The physical structure, the probabilistic nature of that structure, and the terminal behavior as related to that structure are identified. Set theory and probability theory are used. It is pointed out that the system then forms a base for developing such concepts as performance and utility, which in turn are used to define system reliability. Specializations that correspond to certain physically motivated constraints are also presented. M.G.J.

N67-12253*# Smith Electronics, Inc., Cleveland, Ohio.
STUDY OF SHORT-TERM PHASE STABILITY Final Report, Sep. 6, 1965–Sep. 17, 1966
Robert A. Mostrom 17 Sep. 1966 26 p
(Contract NAS8-11592)
(NASA-CR-80105) CFSTI: HC $2.00/MF $0.50 CSCL 09C

Theoretical and experimental work is described leading to the conclusion that at least two mechanisms may be present in subharmonic generators employing charge-storage diodes. One is the generation of negative resistance by a parametric mode of operation; the other is a coincidence and timing mode relating to the abrupt transition phenomenon. Development of a coherent fractional frequency multiplier employing charge-storage diodes in harmonic and subharmonic operation exclusively is also described. A review of selected short-term stability measurement systems is presented, including a description of a phase comparator system employed by the contractor. Author

N67-12278*# Santa Clara Univ., Calif.
ALGEBRAIC METHODS FOR DYNAMIC SYSTEMS
G. J. Thaler, D. D. Siljak, and R. C. Dorf Washington, NASA, Nov. 1966 139 p refs
(Contract NAS2-2609)
(NASA-CR-617) CFSTI: HC $4.00/MF $1.00 CSCL 09C

The mathematical theory of algebraic methods and the techniques developed for the application of algebraic methods to the analysis and design of dynamic systems are summarized. Manipulation of the characteristic polynomial after use of Mitrovic's transformation of variable leads to simultaneous equations which permit mapping s-plane contours on a coefficient plane or parameter plane. Analysis and design may be accomplished with these graphs. Another technique for synthesis involves analytic treatment of the simultaneous equations rather than graph plotting. Both techniques have the advantage of being two parameter methods, with capability of extension to three or more parameters under suitable circumstances. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N67-11706# Union Carbide Nuclear Co., Oak Ridge, Tenn.
A HIGH-PRESSURE GAS MIXING FACILITY
J. L. Heatherly and W. Garland 8 Aug. 1966 12 p ref
(Contract W-7405-ENG-26)
(Y-1546) CFSTI: HC $1.00/MF $0.50

A high-pressure gas mixing facility was constructed in the Y-12 Plant. This facility can be used to prepare both binary and multicomponent gas mixtures with the minor component ranging in concentration from 5 ppm to any percent. A high-pressure pump allows mixtures to be prepared up to a volume of 220 cubic feet at a pressure of 2000 psi. Author (NSA)

N67-11912# Academy of Sciences (USSR), Moscow. Astronomical Committee.
BULLETIN OF STATIONS FOR OPTICAL SATELLITE TRACKING. NO. 44
1965 29 p In RUSSIAN; ENGLISH summary
CFSTI: HC $2.00/MF $0.50

The relation of the radius-vector of the major semi-axis as well as differences of the true and average anomaly are given in the tables for two arguments (the average anomaly and the eccentricity) for satellite orbits with small eccentricity. Author

N67-11913# Academy of Sciences (USSR), Moscow. Astronomical Committee.
BULLETIN OF STATIONS FOR OPTICAL SATELLITE TRACKING, NO. 45
1965 141 p refs In RUSSIAN
CFSTI: HC $4.00/MF $1.00

A chronological listing of all U.S. and Soviet satellites and space probes launched during the period October 4, 1957 through January 1, 1965 is presented. Orbital data are included for each launching. The tabulated information is followed by summaries giving missions, characteristics, and configurations of the satellites, space probes, space vehciles, and programs of the two countries. Transl. by K.W.

N67-11960*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO WIND TUNNEL TESTING PROGRAM—HISTORICAL DEVELOPMENT OF GENERAL CONFIGURATIONS
William C. Moseley, Jr. and Joseph C. Martino (Federal Elec. Corp.) Washington, NASA, Dec. 1966 75 p refs
(NASA-TN-D-3748) CFSTI: HC $2.50/MF $0.75 CSCL 14B

An important phase of the Apollo spacecraft development is the analysis and modification resulting from the application of aerodynamic data acquired through the Apollo wind tunnel testing program. A brief history of the aerodynamic development of the Apollo configurations is presented. Basic vehicle components and the purpose and the scope of the Apollo wind tunnel testing program are discussed, with an introduction to models, facilities, and methods of testing. Problem areas that were encountered in the design evaluation and the methods of their solution are introduced. Author

N67-12093*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
POTASSIUM CORROSION TEST LOOP DEVELOPMENT Quarterly Progress Report, Period Ending Apr. 15, 1966
E. E. Hoffman, ed. 22 Jul. 1966 76 p refs
(Contract NAS3-2547)
(NASA-CR-72042; QPR-11) CFSTI: HC $2.50/MF $0.75 CSCL 14B

The prototype test loop is intended for the evaluation of refractory alloys in boiling and condensing potassium environments which simulate project space electric power systems. Progress in a 5000-hour operation test is reported. Sodium and potassium were distilled from the loop components and samples were taken from each circuit during the draining operation. Calibration of the slack diaphragm pressure transducers and their response characteristics are discussed. The test loop proper and the components were inspected for system degradation or contamination. The Mo–TZM alloy turbine simulator nozzle and blade specimens were evaluated for corrosion or erosion. Evaluation of the test results failed to disclose any significant changes in the condition of the prototype corrosion loop. A preliminary chemical analysis of Cb–1Zr foil and tube specimens indicated that only slight oxygen contamination resulted from exposure in the vacuum environment during the 5000-hour test. K.W.

N67-12115*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.
WIND TUNNELS
J. T. Welton, B. Walker, W. R. Kerr, W. J. Marko, and E. R. Bate, Jr. *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 41–45 ref (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Summary data on wind tunnel tests are presented. In order to make detailed flow measurements in the near wake of a slender two-dimensional wedge with injection of gaseous nitrogen from the base, tests were conducted in a supersonic wind tunnel at a Mach number of 4.0 and a Reynolds number per inch of about 0.25×10^6. Surface pressure and temperature measurements were also made. Data show that small rates of injection of gaseous nitrogen from the base of the model can cause significant changes to the wake structure. To study the static aerodynamic characteristics of possible entry shapes, tests were carried out in the transonic wind tunnel on a series of configurations based on a 60° (half-angle) blunted cone. The effect of sting diameter over the balance shield range of 0.75 and 1.25 in. was shown to be very small. Also mentioned is an experimental investigation conducted in the hypersonic wind tunnel's auxiliary flow channel for measuring the internal pressure distribution of a 15° conical pintle nozzle with an exit Mach number of 4.5. M.G.J.

N67-12126*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN AUTOMATIC ETHYLENE OXIDE DECONTAMINATION SYSTEM
R. H. Silver and S. H. Kalfayan *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 103–107 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

An automated apparatus is described for the decontamination of polymeric products through six identical, controlled cycles. The specified time, temperature, and relative humidity are manually preset; and then automatically maintained for each of the four phases of each cycle. This ethylene oxide-dichlorodifluoromethane contamination system is readily adaptable to varying decontamination parameters, such as ethylene oxide concentration and exposure time, temperature, relative humidity, and flow rate. M.W.R.

N67-12183# Ohio State Univ., Columbus. Aeronautical and Astronautical Research Lab.
AXISYMMETRIC AND PLANAR FREE JETS FOR HYPERSONIC, LOW DENSITY TEST FACILITIES Interim Technical Report, 1 Apr. 1964–15 Nov. 1965
G. M. Gregorek and R. G. Luce Wright-Patterson AFB, Ohio, ARL, Apr. 1966 42 p refs
(Contract AF 33(657)-11060)
(ARL-66-0068; AD-639308) CFSTI: HC $3.00/MF $0.50

The use of axisymmetric and planar free jets to generate hypersonic, low density flow was investigated, and design criteria for producing these flows established. Method of characteristics solutions defining the stream gradients for these flows were verified by pitot pressure surveys and an analytic prediction of Mach disc location was verified by schlieren photography. The experiments indicate that the undesirable high stream gradients of the sonic exit, axisymmetric free jets may be reduced by using short conical extensions to produce jets expanded from Mach numbers greater than unity. A free jet formed by an M = 2 orifice showed both a decrease in stream gradients and an increase in test area caused by an aft movement of the Mach disc. An adverse influence of the Mach disc on a sphere model pressure distribution and shock shape was found when the model, of the same diameter as the orifice, was less than eight diameters upstream of the disc. The planar flows generated by shots showed a substantial reduction in stream gradients when compared with the axisymmetric jets. Full development of the planar flow was not achieved, even with slots of length to height ratio of 200, because of a strong shock system emanating from the ends of the slot. These oblique shocks terminated the isentropic expansion. (Author) TAB

N67-12218*# West Virginia Univ., Morgantown.
NULL GRAVITY SIMULATOR Final Report
Hsi-Feng Yuan, Edward F. Byars, and Robert W. Shreeves [1966] 11 p
(Grant NsG-533)
(NASA-CR-79515) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A coplanar two-bar mechanism with a fixed cam at one axis end and a movable cam at the other end was used to approximate a zero gravity condition for a mass by appropriate prescriptions of the motions of the two bars. Equations for the radial and tangential components of the surface force acting on the

point mass were formed and computer programs were devised to evaluate them. It was concluded that exact solutions for null gravity cannot be found for any mechanism to be constructed on the earth's surface. G.G.

N67-12284# Naval Air Engineering Center, Philadelphia, Pa.
FIXTURE FOR TESTING ABILITY OF INSET RUNWAY GUIDE LIGHTS TO WITHSTAND AIRCRAFT LANDING GEAR LOADS Final Report
G. M. Henig and W. J. Biebel Mar. 1966 41 p
(RD-66-17; NAEL-ENG-7373; AD-631695) CFSTI: HC $2.00/MF $1.50

This report contains design data, design parameters, suggested test methods, structural analysis, and suggested additional test functions of a fixture which will test load capabilities of inset runway guide lights. Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N67-11214 RAND Corp., Santa Monica, Calif.
CALCULATION OF HYDRODYNAMIC RESISTANCE OF ANNULAR CHANNELS
Yu. P. Finat'yev *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer. Vol. I Aug. 1966 p 108–123 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Turbulent flow at the wall in an annular space consisting of the inner and the outer region was examined in the calculation of hydrodynamic resistance of annular channels. For this purpose, the position of maximum velocity in an annular channel was determined, and the hydraulic resistance of an annular channel calculated. Comparisons are made with previously reported experimental data. R.Li.

N67-11216 RAND Corp., Santa Monica, Calif.
FLOW IN CHANNELS WITH PERMEABLE WALLS
I. S. Kochenov, L. I. Baranova, and V. V. Vasil'yev *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer. Vol. I Aug. 1966 p 144–150 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

An equation of motion, which for a channel with constant cross section where the velocity at the wall is perpendicular to the axis can be written in an averaged form, is derived for the change in pressure in a channel with permeable walls. Preliminary experiments were performed to test previously obtained data, and results of about 300 experiments for flows with efflux are graphed in summary form. R.Li.

N67-11234 RAND Corp., Santa Monica, Calif.
NONSTEADY-STATE FLOWS IN PIPES
I. S. Kochenov and Yu. N. Kuznetsov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer. Vol. I Aug. 1966 p 354–363 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Details are given on experimental and theoretical investigations of nonsteady state flows in pipes which were undertaken to find relationships for describing the friction coefficient in these flows. The findings indicate that the fluid friction resistance coefficient in highly nonsteady state flows differs appreciably from its quasisteady state values; it is pointed out that this factor should be considered when calculating a number of processes which vary rapidly with time. Theoretical calculations for laminar flows are compared with experimental data. It was found that the experimentally determined values of Λ differed from unity severalfold; in addition, negative values of Λ were also obtained. M.G.J.

N67-11230# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
VERIFICATION OF THE PROPOSED EQUATION FOR CALCULATION OF THE FORCES ON A SPHERE ACCELERATING IN A VISCOUS FLUID
Fuat Odar Jul. 1966 25 p refs
(RR-190; AD-639207) CFSTI: HC $1.00/MF $0.50

An equation proposed for the calculation of forces on a sphere accelerating in a viscous fluid (Odar and Hamilton, 1964 AD-602 777) is verified by comparing the velocities of spheres falling under gravity in a viscous fluid with those calculated from the equation. The excellent agreement between the experimental and calculated values suggests wide application for the equation Author (TAB)

N67-11260# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL CALCULATION OF TWO-DIMENSIONAL FLOW IN A BOUNDARY LAYER
I. V. Petukhov *In its* Numerical Methods of Solving Differential and Integral Equations and Quadrature Formulas 31 May 1966 p 27–55 refs (See N67-11257 02-23) CFSTI: HC $3.00/MF $0.75

Problems connected with the numerical calculation of a boundary layer for steady flows of an ideal gas which are plane or axisymmetric are discussed. A method of numerical integration of a nonlinear equation of parabolic type with boundary conditions of a general form is given and applied to the calculation of a boundary layer. Examples of the calculations are related to the distributions of the velocity of an external flow which are presented in tabular and analytic form. R.N.A.

N67-11329*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EXPANSION AND FLOW CHARACTERISTICS OF INITIALLY SATURATED SODIUM, POTASSIUM, AND CESIUM VAPORS
Louis J. Goldman Washington, NASA, Nov. 1966 21 p refs
(NASA-TN-D-3743) CFSTI: HC $1.00/MF $0.50 CSCL 20D

An analysis was conducted to determine the type of expansion occurring during the flow of an alkali-metal vapor through a convergent-divergent nozzle. Previously obtained experimental nozzle pressure profile and critical weight flow data at temperatures of 1200° to 1600°F for sodium vapor and potassium vapor were compared with three idealized processes (equilibrium, supersaturated-equilibrium chemical species, and supersaturated-frozen chemical species) to determine the process that best represents the data. Experimental high-temperature thermodynamic properties were used to perform the theoretical calculations. A simplified theory of nucleation was then applied to both supersaturated processes to give a further insight into the process occurring. In addition, the theoretical expansion, flow, and nucleation characteristics of cesium vapor are presented. The experimental data for both sodium and potassium were best represented by the supersaturated-equilibrium chemical species process. Calculations for the supersaturated-equilibrium chemical species process indicated that this process could be approximated by the equation $Pv^n = c$, where P is the absolute pressure, v is the specific volume, n is the expansion index, and c is a constant. The theoretical expansion index values of 1.35 and 1.44 for the supersaturated-equilibrium chemical species process for sodium vapor and potassium vapor, respectively, are recommended for design calculations. Author

N67-11396*# Beech Aircraft Corp., Boulder, Colo. Environmental Test Labs.
LIQUID HYDROGEN PRESSURIZATION TESTS Final Test Report, 29 May 1963–27 Aug. 1964
Albert R. Lowrie, T. Bielawski, and J. R. Mabbitt 25 Nov. 1964 139 p
(Contract NAS8-5331)
(NASA-CR-79093; FR-13832) CFSTI: HC $4.00/MF $1.00 CSCL 20D

Tests were undertaken to supply pressurization data for use in heat exchanger design in the Saturn Missile program. The tests were conducted using a 7000-gallon titanium test tank in the thermal test tower vacuum bell. Sixteen tests were carried out, which consisted of helium and hydrogen gas for pressurization, and four included the application of external heat flux. A chronological program history is given, and details are given on test procedure, titanium tank, external heating program, liquid hydrogen gas diffuser, fast response thermocouple development, and test results.
L.E.W.

N67-11701# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THE DEVELOPMENT AT INFINITY OF AXISYMMETRIC FLOW PATTERNS WITH A FREE STREAM MACH NUMBER ONE
Karl G. Guderley and Mark C. Breiter Apr. 1966 54 p refs
(ARL-66-0066; AD-637530) CFSTI: HC $3.00/MF $0.50

A representation for the flow field at infinity in an axisymmetric flow at a free stream Mach number one was originally given by Guderley by means of similarity solutions. Their determination required the solution of ordinary differential equations. Recently, the solutions of these differential equations in the form of polynomials have been given by Mueller, Matschatt and, in a particularly useful form, by Randall. On this basis it is now feasible to derive a representation for the flow field at a large distance for the full potential equation. This work is carried out in the present report. A possible application lies in the determination of initial conditions for Garabedian's method of analytic continuations. From computations of this kind, one would obtain accurate examples for axisymmetric flow patterns at a free stream Mach number one. Because of certain idiosyncrasies of this application, which will be explained, the present analysis has been carried out in the hodograph. The report gives the basic mathematic theory and a tabulation of some of the polynomials which are needed for the representation of the flow patterns at infinity.
Author (TAB)

N67-11736*# General Dynamics/Convair, Huntsville, Ala.
ASSESSMENT OF SLOSH COUPLING WITH SPACE VEHICLE Final Report
L. L. Fontenot and M. O. Clark 24 Oct. 1966 83 p refs
(Contract NAS8-20302)
(NASA-CR-79541; GD/C-DDF-66-008) CFSTI: HC $3.00/MF $0.75 CSCL 20D

Results of an analytical study to determine the role of the action of the liquid in attitude stability equations of liquid propellant space vehicles are presented. The planar perturbation equations of motion for a liquid propellant launch vehicle have been formulated. The vehicle motion was treated as a summation of perturbations from a known reference motion and motion in which vehicle body axes remain coincident with reference axes. The effects of the liquid in the perturbation equations were isolated and identified. On replacing the liquid motion by a simple mechanical system, the planar perturbation equations of motion for the vehicle were again derived. The role of the liquid motions and mechanical motions were then compared; it was shown that the mechanical system did exactly duplicate the action of the liquid. The analysis was then extended to tanks of arbitrary shape having rotational symmetry. Again, the mechanical system was shown to duplicate the action of the liquid. However, the equation expressing the constancy of pressure at the free surface was found to contain an additional term proportional to the angular displacement of the body axes with respect to the reference axes.
Author

N67-11748# Institut fur Plasmaphysik G.m.b.K., Garching (West Germany).
MONTE CARLO SIMULATION OF THE FLOW OF A KNUDSEN GAS WITH DUE ALLOWANCE FOR THE SOJOURN TIME [MONTE-CARLO-SIMULATION DER STROEMUNG EINES KNUDSEN-GASES UNTER BERUECKSICHTIGUNG DER VERWEILZEIT]
Rudolf Gorenflo, Maria Grazia Pacco, and B. M. U. Scherzer Nov. 1965 42 p refs In GERMAN; ENGLISH summary
(IPP-2/41; IPP-6/46) CFSTI: HC $2.00/MF $0.50

The initial flow of a Knudsen gas through a long, thin tube is discussed. The intention is to determine from the measured intensity of the outflow at the end of the tube the distribution density of the sojourn of the gas molecules on the tube wall. For this purpose an integral equation is formed. Because of the complications involved a numerical solution was not contemplated, an attempt being made instead to approximate the known intensity of the outflow by trial substitution of various sojourn distributions. This was abandoned owing to the enormous computing time required. Further simulation is made to investigate the degree of approximation with which the flow may be regarded as a diffusion process. It is found that the flow is not a diffusion process. The deviation is caused by 5 to 9% of the particles (those travelling too far).
Author

N67-11820*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLOW-VISUALIZATION STUDIES OF A CONFINED, JET-DRIVEN WATER VORTEX
E. J. Roschke 15 Sep. 1966 35 p refs
(Contract NAS7-100)
(NASA-CR-79941; JPL-TR-32-1004) CFSTI: HC $1.00/MF $0.50 CSCL 20D

Visual observations, in the form of photographs and sketches, of the flow of water within a confined, jet-driven vortex tube are presented and discussed. This vortex tube had a fixed nominal diameter of 4 inches, but was of variable length so that effects produced by changes in aspect ratio could be studied. The basic configuration, having planar endwalls and a single exit hole, was modified by changing the shape of the endwalls and/or installing exit holes at both ends. Conical, hemispherical, and canted endwalls were investigated. The results of other experiments such as injection of a second, heavier-than-water fluid, the insertion of probes into the flow, and the transient effects of changes in mass rate of flow supply are also discussed. It is demonstrated that aspect ratio has a strong influence on the secondary flows in a confined vortex. The principal results are given in the form of color photographs typical of several flow conditions.
Author

N67-11860*# Maryland Univ., College Park.
PROGRAM TO COMPILE AND EVALUATE DIFFUSIVITY AND VISCOSITY DATA First Annual Report
Nov. 1966 164 p refs
(Contract NGR-20-002-053)
(NASA-CR-79930) CFSTI: HC $5.00/MF $1.00 CSCL 20D

Progress is reported in the following studies: (1) data evaluation of the diffusion coefficients of the systems He–N_2, Ar–N_2, and Ne–Ar, during which diffusion measurements were correlated as a function of temperature and results were weighted according to method; (2) evaluation of the liquid phase molecular transport coefficients, which includes both aqueous and non-aqueous solvent systems with ionizing solutes; (3) diffusion of gases in polymer-diluent systems, which discusses the various sources that were used in a literature search; (4) diffusion in inorganic solids, where a literature search was concentrated on self-diffusion in the silver and alkali halides; and (5) compilation and evaluation of

turbulent transport data, which includes heat, porous media, boundary layers, mass, and momentum transport in conduits within confined flow, and jets, streams, meteorological, and oceanographic flow within the free flow field. Bibliographies are presented for each study. K.W.

N67-11873# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
SOME RESULTS ON THE CHARACTERISTICS OF THE TEMPERATURES OF TURBULENT BOUNDARY-LAYERS AT INCREASED TEMPERATURES [QUELQUES RESULTATS SUR LES CARACTERISTIQUES THERMIQUES DES COUCHES LIMITES TURBULENTES A TEMPERATURE ELEVEE]
Roger Michel and Pierre Mantré Repr. from AGARDograph No. 97, Pt. I, May 1965 p 65–95 refs In FRENCH; ENGLISH summary
(TP-216(1966)) CFSTI: HC $2.00/MF $0.50

This paper is devoted to the analysis of turbulent boundary-layers at temperatures sufficiently high for dissociation to occur. In the first part the enthalpy distributions and the concentration in a flat plate boundary-layer are studied by means of a combination of the local boundary-layer equations in the cases of the perfect gas and of the real gas either frozen or at equilibrium. The ratio of the heat flux to the wall friction is thus deduced. The results obtained are used in the second part to calculate the heat transfer on rounded fore-bodies by integration of the global energy equation. Author

N67-11880# Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
A STUDY OF THE INFLUENCE OF MICROBUBBLES ON HYDRODYNAMIC FLOW NOISE Final Report, Oct. 1964–Mar. 1966
John M. Killen and Scott D. Crist Apr. 1966 26 p refs
(Contract Nonr-710(65))
(Rept.-82; AD-638980) CFSTI: HC $2.00/MF $0.50

A test facility was constructed for the measurement of flow noise generated by a rotating cylinder in water. Measurements were made of radiated flow noise in water for a frequency range of 5 to 80 kiloHertz. The surface velocities of the cylinder were varied from 44 to 100 fps. The total air content of the water was varied from 7 to 27 ppm. The radiated flow noise was observed to increase as the sixth power of the surface velocity for low frequencies. For high frequencies, the flow noise increased as the tenth power of the velocity. Release of air bubbles by shear had no effect on radiated flow noise other than to reduce the measured level of the noise Author (TAB)

N67-11898# Michigan Univ., Ann Arbor.
BOUNDARY LAYER ANALYSIS OF TWO-PHASE (LIQUID-GAS) FLOW OVER A CIRCULAR CYLINDER AND OSCILLATING FLAT PLATE
M. E. Goldstein, Wen-jei Yang, and J. A. Clark Wright-Patterson AFB, Ohio, ARL, Jan. 1966 363 p refs
(Contract AF 33(657)-8368)
(ARL-66-0010, Pt. IV; AD-639217) CFSTI: HC $7.00/MF $1.75

Flow is assumed two dimensional, and gravity, vaporization of the liquid phase, and compressibility are ignored. The liquid is assumed to be in the form of small drops far upstream from the body. The liquid film which forms on the surface of the body due to drop impingement is analyzed extensively. In the case of the cylinder the analysis is started from the full incompressible Navier-Stokes and energy equations in the film which are simplified by using dimensional arguments. For the flat plate the boundary layer approximations are assumed to hold a priori in the film. Solutions to the governing equations and boundary conditions are carried out by a series expansion technique which results in a series of ordinary differential equations which have been solved numerically on a 7090 computer. The solutions are used to calculate velocity and temperature profiles in the film and also such physical quantities as local film thickness, local Nusselt Number, and local skin friction. The analysis shows that in general there is a significant increase in heat transfer as well as skin friction over what would be obtained from a single component gas flow. In the case of the flat plate only a very small permanent change in the heat transfer was found due to the oscillations. In the case of the cylinder a peaking in the heat transfer, film thickness and skin friction was found with respect to the parameter E squared (the product of the volume fraction of the liquid in the free stream, squared, and the diameter Reynolds number based on liquid properties). TAB

N67-11919# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
KINETIC THEORY AND RAREFIED GAS DYNAMICS
Jean-Pierre Guiraud 1966 29 p refs Presented at the 5th Symp. on the Dyn. of Rarefied Gases, Oxford, 4–8 Jul. 1966
(TP-379(1966)) CFSTI: HC $2.00/MF $0.50

Various applications of kinetic theory which are discussed in light of rarefied gas dynamics include shock structure and asymptotic theory; mention is made of the use of a variational principle, a two-sided distribution approach, and free jet expansion. The Boltzmann equation and some of its simplest properties are detailed, and some exact solutions of the Boltzmann equation are treated. The linear Boltzmann equation is discussed in terms of small departures from equilibrium, and details for its use are given. Consideration is given to the mathematics of models of the collision operator that have been devised to obtain either approximations or exact numerical solutions. M.W.R.

N67-11930# Office of Naval Intelligence, Washington, D. C. Translation Section.
STATE OF GAS BEHIND FRONT OF A STRONG SHOCKWAVE [SOSTOYANIYE GAZA ZA FRONTOM SIL'NOY UDARNOY VOLNY]
L. M. Biberman and I. T. Yakubov 17 Aug. 1966 19 p Transl. into ENGLISH from Teplofiz. Vysokikh Tempeatur (USSR), v. 3, no. 3, 1965 p 340–353
(ONI-TRANS-2172; TT-66-60531; AD-639147) CFSTI: HC $1.00/MF $0.50

An appropriate system of the equations is recorded and an approximate method of its solution is proposed that takes into account the role of the excited states. In particular, shock waves in air at velocities $v1 > \infty = 10$ km/sec are examined. TAB

N67-11957*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PSEUDO-SONIC VELOCITY AND PSEUDO-MACH NUMBER CONCEPTS IN TWO-PHASE FLOWS
Joseph W. Bursik Washington, NASA, Dec. 1966 59 p refs
(NASA-TN-D-3734) CFSTI: HC $2.50/MF $0.75 CSCL 20D

In ideal gas theory, the introduction of the Mach number into the analysis of steady, one-dimensional duct flow results in associating choking conditions with a Mach number of unity for several well known flows, such as Rayleigh and Fanno pipe flows and isentropic converging–diverging duct flow. Replacing the ideal gas by a liquid-vapor, two phase mixture in the above named flows complicates the analysis even when equilibrium between the phases is assumed. However, it is possible to introduce a pseudo-sonic velocity concept with a correspondingly defined pseudo-Mach number concept such that these three two-phase flows exhibit choking conditions at a pseudo-Mach number of unity. It is further shown that a point-by-point, non-tabular analysis of the above two-phase flows is possible when the equations for the Gibbs' function and the vapor pressure curve are known. In the case of the liquid-vapor region of H_2O an empirical equation for the Gibbs' function is derived, while the vapor pressure curve is developed theoretically by the imposition of a transformation property normally encountered in ideal gas theory. Author

N67-11958*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF LIQUID OUTFLOW FROM CYLINDRICAL TANKS DURING WEIGHTLESSNESS
Joseph D. Derdul, Lynn S. Grubb, and Donald A. Petrash Washington, NASA, Dec. 1966 18 p refs
(NASA-TN-D-3748) CFSTI: HC $1.00/MF $0.50 CSCL 20D

As part of a study of the behavior of rocket engine propellants in space vehicle tanks exposed to weightlessness, an investigation was conducted to determine the behavior of the liquid-vapor interface during outflow from a cylindrical container. The distortion of the interface, expressed as a dimensionless distortion parameter, was correlated with the Weber number (ratio of pressure to capillary forces) with initial filling as a parameter. The distortion parameter was an approximate measure of the fraction of liquid remaining on the tank walls during outflow, and was therefore related to the total amount of liquid remaining in the tank at the time of vapor ingestion into the outlet. The distortion parameter increased as the Weber number increased to a value of approximately 2, and appeared to remain constant for higher Weber numbers. In general, the distortion parameter increased with lower initial fillings. Three tank bottom and outlet configurations were included in the study. The shape of the tank bottom and the position of the outlet had essentially no effect on the distortion parameter. Author

N67-11964# Aix-Marseilles Univ. (France). Fluid Mechanics Inst.
RESEARCH ON THE EVOLUTION OF HIGH TEMPERATURE GASES. I: MEASUREMENT OF RELAXATION OF NON-DISSOCIATED NITROGEN IN A SHOCK WIND TUNNEL
J. Fauchas and H. Guenoche [1966] 50 p refs In FRENCH
(Contract DRME-65-34311-00-480-75-01)

Equations which describe one-dimensional flow as well as equilibrium and near equilibrium flow are given in connection with the high temperature measurements of non-dissociated nitrogen in a hypersonic shock tunnel. Method employed was adapted from one of Stollery, Smith, and Park; and the initial equilibrium flow was compared to one-dimensional flow. A simplified procedure is offered which has certain limitations, but presents acceptable results. Details are given for the various equations which presuppose one-dimensional flow, including equations of energy, motion, relaxation of vibration, and state. Transformation of the flow equations is detailed, and method of the numerical integration are given. Specific equations for equilibrium and near equilibrium flow are detailed; and some applications of the proposed method are included. The geometry and other aspect of the wind tunnel are discussed, and the influence of temperature characteristics, relaxation time, and other factors are treated. Transl. by M.W.R.

N67-11975# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
DISCUSSION OF THE STABILITY OF INTERMEDIATE SOLUTIONS IN THE ANALYSIS OF DISCHARGED FLOW [DISCUSSION DE LA STABILITE DES SOLUTIONS INTERVENANT DANS L'ANALYSE DES ECOULEMENTS RELAXES]
Roger Prud'homme 1966 51 p refs In FRENCH Presented at the 7th Symp. of AGARD on the Recent Progr. in Aerothermochem., Oslo, 16–20 May 1966
(TP-360(1966)) CFSTI: HC $2.00/MF $0.50

Stationary, one-dimensional, free-flow general equations are presented as a function of temperature, pressure and composition for a perfect, or ideal, gas mixture. Two theories are summarized on the stability of free-flow solutions. Small-perturbation equations are derived and a preliminary study is advanced for constant and variable coefficients. Analytical results show the role of kinetic and thermodynamic matrixes entering into any type of flow; and, a detailed analysis is given for the one-dimensional, adiabatic flow in a nozzle. Transl. by R.U.

N67-11979# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
CONTRIBUTION TO THE EXPERIMENTAL STUDY OF THE TURBULENT MIXED LAYER ISOBAR OF A SUPERSONIC FLOW [CONTRIBUTION A L'ETUDE EXPERIMENTALE DE LA COUCH DE MELANGE TURBULENT ISOBARE D'UN ECOULEMENT SUPERSONIQUE]
Maurice Sirieix and Jean-Louis Solignac 1966 30 p refs In FRENCH Presented at the Meeting of AGARD Specialists on Detached Flows, Rhode St. Génèse, France, 10–13 May 1966
(TP-327(1966)) CFSTI: HC $2.00/MF $0.50

Theory was reviewed, and experimental results analyzed for the case of an isobaric turbulent mixing layer in supersonic flow. Emphasis is on preexisting boundary layer conditions in the development of dynamic, thermal, and chemical mixing. Theoretical results obtained were used to study velocity, temperature, and concentration profiles during the process of mixing. Transl. by R.U.

N67-12029# General Electric Co., Philadelphia, Pa. Missile and Space Div.
EXACT SOLUTIONS TO THE NAVIER–STOKES EQUATIONS WITH CURL FREE CONVECTIVE ACCELERATIONS
Sheldon Weinbaum and Vivian O'Brien (APL) Sep. 1966 34 p refs
(R66SD61)

A general analysis in curvilinear streamline coordinates is developed in order to investigate systematically the behavior of all possible two-dimensional and axially-symmetric fluid motions with curl free convective accelerations that are exact solutions to the incompressible Navier–Stokes equation. The analysis includes: (a) all flows where the convective terms vanish, (b) irrotational flows, $\bar{\omega} = 0$, (c) Beltrami flows and (d) all other fluid motions that satisfy the kinematic constraint curl $\nabla \times \bar{\omega} = 0$. Specific solutions are referenced, derived or deduced by analogy with a related mechanical problem to give the reader a qualitative idea of the physical behavior of a class of motions. New exact solutions are presented for two-dimensional motions with cross flow and axially-symmetric motions with swirl. Author

N67-12081# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
HYPERSONIC FLOWS PAST TRANSVERSE JETS Final Report
Louis G. Kaufman, II Aug. 1966 79 p refs
(Contract NOw-65-0396-c)
(RE-263; AD-637870) CFSTI: HC $3.00/MF $0.75

Reaction jets, when used within the atmosphere, can interact strongly with the local stream flow over a vehicle, and produce a resulting force that is much larger than the pure reaction force. Increased surface pressures, caused by the interaction of hypersonic streams with essentially two dimensional transverse jets, are found experimentally to depend strongly on jet and local stream flow conditions. Unlike interactions with supersonic stream flows, overpressures measured on the surface downstream of the jet orifice can contribute the major portion of the interaction force. Although weaker jets are generally more effective, giving greater amplification of the reaction force, the interaction force is greatly reduced when the jet flow is immersed in a thick boundary layer. Shock tunnel results obtained for local stream flow Mach numbers from 9 to 18 are presented and compared with analytical methods for predicting the interaction pressure distribution. Generally, the increased pressure levels can be estimated and used to obtain a first order correction to the interaction force. However, the extent of flow separation and details of the pressure distribution cannot be predicted adquately without additional information. Test results for transverse jet control forces compare favorably with those generated by a typical trailing edge flap Author (TAB)

N67-12182# IIT Research Inst., Chicago, Ill.
INVESTIGATION OF SWIRLING FLOWS IN DUCTS Final Report
Z. Lavin (Ph.D. Thesis) and A. A. Fejer Wright-Patterson AFB, Ohio, ARL, May 1966 239 p refs Submitted for Publication
(Contract AF 33(615)-2122)
(M6117; ARL-66-0083; AD-639325) CFSTI: HC $6.00/MF $1.25

The work reports on theoretical and experimental investigations of swirling flows in cylindrical ducts. Steady state solutions were obtained for laminar incompressible swirling flow in the entrance region of a straight circular duct of uniform cross-section by solving the complete navier stokes equations using the stream function, the angular momentum and the tangential component of vorticity as variables. The analysis was also adapted to the solution of unsteady flows and as an example, an impulsively-started flow was treated. In addition, a method was suggested for the study of the hydrodynamic stability of laminar swirling flows. Finally it was demonstrated that for the flows under consideration the analytical incompressible solutions are also representative of the characteristics of swirling compressible flows. In the experimental part of the investigation, a swirling flow of air was observed in a thirty-inch long, three-inch diameter duct. Author (TAB)

N67-12184# Princeton Univ., N. J. Gas Dynamics Lab.
ON HYPERSONIC VISCOUS FLOW NEAR A SHARP LEADING EDGE
Richard W. Garvine Wright-Patterson AFB, Ohio, ARL, Jun. 1966 79 p refs *Its* Rept.-755
(Contract AF 49(638)-1271; Grants AF-AFOSR-112-63; NSF GP-579)
(ARL-66-0102; AD-639382) CFSTI: HC $3.00/MF $0.75

Theoretical inquiry is made into the high speed viscous flow past a sharp-edged flat plate whose surface is aligned with the oncoming flow. Basic information is sought concerning the fundamental nature of the flow field in regions near the leading edge. The role of upstream conditions is found to be fundamental. Study is made of the viscous layer region on the two-dimensional flat plate ahead of the strong interaction region. The Navier-Stokes equations applied to the flow are up to the point where continuum treatments are no longer justifiable. Two initial velocity profiles were assumed in order to examine the details of the theory. Neither form proved to yield realistic flow fields in the light of experimental results. Computations from these two profile forms, however, did serve to bring out the sensitivity of the flow throughout the viscous layer region to initial conditions. It is concluded, in consequence, that the flow cannot be described by similar solutions or other solutions which ignore these initial values Author (TAB)

N67-12187# ARO, Inc., Arnold Air Force Station, Tenn.
FLOW FIELD AND SURFACE PRESSURE MEASUREMENTS IN THE FULLY MERGED AND TRANSITION FLOW REGIMES ON A COOLED SHARP FLAT PLATE Technical Report, Oct. 1964–Dec. 1965
Manfred Becker and David E. Boylan Arnold Eng. Develop. Center, Sep. 1965 60 p refs Presented at the 5th Intern. Symp. on Rarefied Gas Dyn., Oxford, 4–8 Jul. 1966
(Contract AF 40(600)-1200)
(AEDC-TR-66-111; AD-638804) CFSTI: HC $3.00/MF $0.75

The experimental survey of the flow field near the leading edge of a cooled, sharp flat plate parallel to a hypersonic stream of low density is discussed. Results consisting of impact pressure and hot-wire anemometer profiles plus surface pressures are analyzed and compared to recent theoretical results. Data are presented for viscous interaction parameters as high as 2.0 Author (TAB)

N67-12191# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
AN EXPERIMENTAL INVESTIGATION OF THE GENERATION OF WATER WAVES BY AIR SHEAR FLOWS
Ashok Kumar Gupta Jun. 1966 142 p refs
(Contract Nonr-1841(89))
(ASRL-TR-116-3; AD-638728) CFSTI: HC $4.00/MF $1.00

A tank of length 46 in., width 12 in., and depth 5 1/4 in., tipped with a 4 1/2 in., long aluminum plate was filled with ordinary tap water and was placed parallel with a uniform air stream of low turbulence. Visual observations of the water free surface were made in the air speed range of 2 FPS to 26 FPS. (1) Allowing for the effects of slightly accelerating air flow and the finite length of the tank, the measured mean velocity profiles of the laminar air boundary layer agree in all essential aspects with Lock's velocity profile computed for zero pressure gradient. (2) Water wave generation by wind with laminar boundary layers consists of two phenomena: maintenance of water wave and initiation of water wave. A relatively low air speed can maintain a relatively long water wave but cannot initiate it. For the laminar boundary layer water waves of wavelengths 2 to 3 cm first appear at air speeds of 530 to 595 cm/sec. For the turbulent boundary layer the water waves first appear at air speeds of 360-400 cm/sec. (3) For air speeds greater than 23 FPS with the boundary layer laminar a Kel. Helm. type instability seems to occur. (4) Customary plots of neutral oscillations of Tollmien Schlichting waves modified by the water surface made for air speeds of 11.3, 17.5 and 20.6 FPS suggest a destabilising effect of the water surface. TAB

N67-12220*# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
GAS CONTENT, SIZE, TEMPERATURE AND VELOCITY EFFECTS ON CAVITATION INCEPTION Internal Report No. 31
Frederick G. Hammitt, David M. Ericson, and M. John Robinson Aug. 1966 60 p refs
(Grant NsG-39)
(NASA-CR-79514; Rept.-03424-31-i) CFSTI: HC $3.00/MF $0.75 CSCL 20D

Results of a comprehensive investigation of the effects of several variables on cavitation inception in a venturi are reported. These include total air content, venturi throat size and velocity with water as the test fluid. The effects of gas content, venturi throat size, surface roughness, velocity, and fluid temperature, with mercury as the test fluid are also examined. Data were correlated using a computerized least mean square regression analysis. A final correlation of all measured cavitation numbers with Reynolds number, based on venturi throat diameter and velocity, is also included. Author

N67-12245*# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
GAS CONTENT, SIZE, TEMPERATURE AND VELOCITY EFFECTS ON CAVITATION INCEPTION Internal Report No. 31
Frederick G. Hammitt, David M. Ericson, and M. John Robinson Aug. 1966 60 p refs *Its* Rept.-03424-31-i
(NASA-CR-80169) CFSTI: HC $3.00/MF $0.75 CSCL 20D

The results of a comprehensive investigation into the effects of several variables on cavitation inception primarily, in a venturi, are reported. These include total air content, venturi throat size and velocity with water as the test fluid. The effects of gas content, venturi throat size, surface roughness, velocity, and fluid temperature, with mercury as the test fluid are also examined. The data was correlated using a computerized least mean square regression analysis. A final correlation of all measured cavitation numbers with Reynolds number, based on venturi throat diameter and velocity, is also included. Author

N67-12249*# Texas A&M Univ., College Station. Low Speed Wind Tunnel Section.
GUST SIMULATION IN A WIND TUNNEL

Richard E. Thomas Oct. 1966 81 p refs
(Grant NGR-44-001-036)
(NASA-CR-80120) CFSTI: HC $3.00/MF $0.75 CSCL 20D

Initial studies of the use of air injecton nozzles to produce simulated gusts in a wind tunnel are reported. Longitudinal gusts were produced at frequencies above 50 c.p.s. with amplitudes of 5.5 f.p.s. in an 83 f.p.s. stream. At lower frequencies gusts with amplitudes up to 21 f.p.s. were produced. The frequency response characteristics of the injector-tunnel system were measured. Upstream injection was much more efficient than was downstream injection. Further studies are planned. Author

N67-12289# Politecnico di Torino (Italy).
RESEARCHES ON RAREFIED GAS DYNAMICS, HYPERSONIC FLOW AND TURBULENT FLOW PERFORMED AT THE INSTITUTE OF APPLIED MECHANICS, POLITECNICO DI TORINO ITALY Final Scientific Report
Carlo Ferrari Jan. 1966 10 p refs
(Grant AF-EOAR-63-98)
(AFOSR-66-0899; AD-634051) CFSTI: HC $1.00/MF $0.50

(1) Experimental researches with the shock tube; (2) experimental study on the influence of different pressure distribution laws on turbulent flow; (3) theoretical study on the interaction between a rigid wall and a molecular beam or a free molecule flow; (4) theoretical researches on low density hypersonic flow; (5) theoretical study of shock wave structure; and (6) theoretical study on incompressible laminar boundary layer. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N67-11237# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LARGE APERTURE SEISMIC ARRAY CAPABILITIES
Paul E. Green, Jr. and Ralph V. Wood, Jr. 12 Jul. 1966 28 p refs
(Contract AF 19(628)-5167; ARPA Order 512; Proj. Vela Uniform)
(TR-421; ESD-TR-66-361; AD-639197) CFSTI: HC $2.00/MF $0.50

The report presents the results of a study of the effectiveness of the experimental Large Aperture Seismic Array in Montana. An attempt has been made, where possible, to draw conclusions from the study of this one station about the performance that might be expected from a worldwide net of several of them. The report discusses the reliability and continuity of observations obtainable from a LASA system, the threshold level for automatic detection and location of weak events, the various signal-to-noise enhancement processes available for on-line and off-line use, and the effect of such enhancements on the ability to discriminate source type. The engineering approaches and system organization that were chosen appear to have resulted in a system of high reliability in the presence of normal component failures, noise, and seismic interference. The 50 percent detection threshold being currently achieved by relatively crude on-site processing is estimated at magnitude 3.5. Off-line processing gains in signal-to-noise ratio equivalent to a magnitude differential of 1-1/4 over a single seismometer output are available. The improvement in ability to see waveform features for identification depends on the type of feature being examined. For first motion, it varies with the signal-to-noise gain; for pP, it is significantly larger.
Author (TAB)

N67-11284# Massachusetts Inst. of Tech., Cambridge. Dept. of Geology and Geophysics.
IMPROVED HIGH-RESOLUTION SEISMIC PROFILING
Donald Jay Krotser (M.S. Thesis) Jun. 1966 52 p refs
(Contract Nonr-1841(74))
(AD-639199) CFSTI: HC $3.00/MF $0.50

High repetition-rate seismic reflection profiling is a technique used at sea to obtain visual analogues of geologic cross-sections. The thesis reports the development of a high resolution profiling system which was field-tested in Boston Harbor. The system incorporates several improvements over conventional apparatus. Visual display of the profiles is produced from playback of magnetic tape-recordings. A tape-recording is used to trigger the sweep and to modulate the beam of a cathode-ray tube; successive traces are recorded across slowly-moving 35 mm. film. Electronic sweep control and optical stacking onto photographic emulsion allow greater flexibility and dynamic range than the mechanical sweep stacking on electro-sensitive paper employed by pre-existing facsimile recorders. Edgerton's boomer sound source was modified to eliminate cavitation and to give non-oscillatory acoustic pulses of 118 decibels peak pressure (relative to 1 dyne/sq cm at 1 meter). The initial impulse (0.1 millisecond long) is followed by a slow decay which provides low-frequency energy for deeper penetration
Author (TAB)

N67-11325*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESERT SOIL COLLECTION AT THE JPL SOIL SCIENCE LABORATORY
Roy E. Cameron, Gerald B. Blank, and Doris R. Gensel 15 Oct. 1966 160 p refs
(Contract NAS7-100)
(NASA-CR-79873; JPL-TR-32-977) CFSTI: HC $3.25/MF $1.00 CSCL 08G

Desert soils and other geologic materials collected from 100 sites in desert regions comprise the Desert Soil Collection. Approximately 400 samples have been obtained from the surface to depths of 1 m since 1961, primarily from arid and semi-arid regions in the United States. Most of the samples are from California deserts. Additional samples have been obtained from arid or semi-arid regions of Baja California and Sonora, Mexico, several states of Argentina and Chile, and Egypt, U.A.R. A list of samples in the Collection is provided in this Report, along with descriptive information on the location and characteristics of the collection site, including photographs of the terrain and soil. Various NASA agencies and contractors have used soils in the Collection for test purposes in research related to extraterrestrial life detection, sampling, and harsh environmental studies. Some of the samples were taken from areas used subsequently for training U.S. astronauts for Moon exploration.
Author

N67-11363*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITIVE ION COMPOSITION AND DENSITY IN THE LOWER E-REGION, FROM 87 TO 114 KILOMETERS
C. R. Smith, H. C. Brinton, M. W. Pharo, III, and H. A. Taylor, Jr. Jun. 1966 23 p refs
(NASA-TM-X-55582; X-621-66-288) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A ceramic positive ion mass spectrometer of the Bennett type, mounted in an ejected payload package, was carried to 114 km altitude at midday in May 1962. Nitric oxide and molecular oxygen were the predominant ions measured in the 87 to 114 altitude range. Near 100 km these ions were approximately equal in concentration. Above this altitude NO^+ increased in concentration to 113 km where it was 10^5 ions/cm^3, while the concentration of O_2^+ was 4×10^4 ions/cm^3. The concentration of each of the other ions observed, 24^+ and 28^+, was less than either of the predominant constituents. The ion 28^+, identified as molecular nitrogen and/or silicon, was observed between 103 and 114 km, and reached a peak density of 10^4 ions/cm^3 at 113 km. The ion 24^+, identified as magnesium, exhibited two distinct layers of concentration, the lower near 93 km and the upper at 113 km; the maximum concentration of this ion was 1.5×10^3 ions/cm^3 at 90 km to 10^4

ions/cm^3 at 110 km. This measurement showing that NO^+ and O_2^+ are of approximately equal concentration in the lower E-region compares favorably with similar measurements made by other investigators; the significance of this result is examined in the light of current theories which treat the relative importance of NO^+ and O_2^+ and the removal of N_2^+ ions in this region. Author

N67-11364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NEUTRAL SHEET IN THE GEOMAGNETIC TAIL: ITS MOTION, EQUIVALENT CURRENTS, AND FIELD LINE CONNECTION THROUGH IT
T. W. Speiser and N. F. Ness Jun. 1966 38 p refs
(NASA-TM-X-55586; X-612-66-290) CFSTI: HC $2.00/MF $0.50 CSCL 04A

From March 22 to May 26, 1964, during orbits 30 through 47, the Imp-1 satellite was located within the earth's magnetic tail and measurements of the imbedded neutral sheet were possible. Forty-two observations of magnetic field reversals accompanied by a decrease in the field magnitude were detected. Of these, 38 are identified as crossings of a well developed magnetic neutral sheet or current sheet. The relatively thin neutral sheet lies within a broad region of magnetic field depression and plasma enhancement, or "plasma sheet". The neutral sheet frequently appears to be moving relative to the satellite with a maximum velocity of a few kilometers per second and on many orbits multiple crossings occur. The formation of the sheet appears to begin near the magnetic equatorial plane at a geocentric distance of $10 \pm 3R_E$. The sheet thickness appears to be larger close to the Earth and the dawn side of the tail and smaller farther away and toward the noon-midnight meridian. At its thinnest region the sheet appears to be about 500 km thick and about 5000 km at the thickest part. The normal component of magnetic field within the sheet appears from these measurements to be 1 to 4 gammas toward the dawn side of the tail and less than 1 gamma near the noon-midnight meridian plane. Author

N67-11369*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL PLASMA MEASUREMENTS WITHIN THE MAGNETOSPHERE
G. P. Serbu and E. J. R. Maier July 1966 14 p refs
(NASA-TM-X-55591; X-615-66-328) CFSTI: HC $1.00/MF $0.50 CSCL 04A

It has been observed that both the ion and electron components of the plasma present within the magnetosphere exhibit, at most times, a Maxwell-Boltzmann energy distribution. The temperature of the electron gas increases by a factor of about 10 from above the ionosphere to an altitude of 2.5×10^4 km ($5R_E$ geocentric). Over this same region, the density decreases to a minimum of about 50 cm^{-3}. Less pronounced variations of temperature and density with radial distance are noted beyond $5R_E$. The simultaneous observation of ion and electron density profiles provides verification of charge neutrality over vertical dimensions of the order of kilometers. Author

N67-11374*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL BEHAVIOR OF THE IONOSPHERE AT 1,000 KILOMETERS ALTITUDE
L. H. Brace, B. M. Reddy and H. G. Mayr Aug. 1966 48 p refs
(NASA-TM-X-55599; X-621-66-362) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Explorer XXII electrostatic probe measurements of electron temperature (T_e) and concentration (N_e) at the 1,000 kilometer level during the period from November 1964 to May 1965 are presented and discussed. Precession of the orbital plane during this period has permitted the resolution of two full diurnal cycles of ionospheric behavior at this altitude, one centered on the winter solstice and one on the vernal equinox. In both seasons, the latitudinal distributions of N_e and T_e reveal a diurnal modulation at middle and low latitudes which appears consistent with a mechanism of thermal expansion and contraction of the protonosphere along the geomagnetic field lines. Although there is a strong tendency toward symmetry about the magnetic equator, an important seasonal effect is evident as an enchancement of N_e throughout the summer hemisphere. Author

N67-11375*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF PRECESSION AND NUTATION
James P. Murphy Aug. 1966 16 p refs
(NASA-TM-X-55600; X-547-66-363) CFSTI: HC $1.00/MF $0.50 CSCL 08E

Transformations to account for the precession and nutation in the equator and equinox of earth are given in units of degrees, with time measured in Julian days and initial epoch of 2436099.5 J.D., the Julian Date for Space. Author

N67-11686*# Dudley Observatory, Albany, N. Y.
HIGH ALTITUDE BALLOON-TOP COLLECTIONS OF COSMIC DUST
C. L. Hemenway, D. S. Hallgren, and R. E. Coon [1966] 12 p refs Presented at the Cospar Meeting, Vienna, May 1966.
(Grant NsG-155)
(NASA-CR-79623) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Fluxes of cosmic dust particles incident on the earth's atmosphere have been measured at high altitude with a balloon-top collection technique. Particle flux enhancements of 5 to 100 times have been observed at times of meteor shower activity. Typical particles and comments concerning their chemical analyses are presented. Evidence concerning the absence of crystal structure in cosmic dust particles is presented. Fluxes obtained by this technique are compared with those from rocket collection and satellite microphone techniques. Author

N67-11724*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
THERMAL CONDUCTION AND ION TEMPERATURES IN THE IONOSPHERE
Peter M. Banks 10 Oct. 1966 18 p refs
(NASA-CR-79534; SR-281)

An analysis is made of the ion energy balance equation for the ionosphere including the effects of O^+, He^+, and H^+ ions, thermal conduction, and the cooling by atomic hydrogen and helium. It is shown that thermal conduction strongly affects the ion temperature profile for conditions of moderate and low electron densities and that the high altitude ion temperature can be significantly less than the electron temperature. In addition, H^+ in concentrations as low as 10% of the total ion density is found to be a major recipient of heat from the ionospheric electron gas and has an important influence upon the total ion energy budget. Author

N67-11726*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
THE TEMPERATURE COUPLING OF IONS IN THE IONOSPHERE
Peter M. Banks 20 Oct. 1966 37 p refs
(Grant NsG-134-61)
(NASA-CR-79492; SR-282) CFSTI: HC $2.00/MF $0.50 CSCL 04A

Investigated was the extent to which O^+, He^+, and H^+ ions can be considered as having a common temperature in the ionosphere. By assuming that each ion gas has its own Maxwellian velocity distribution, energy balance equations including the effects of heating by the electron gas, cooling by the neutral

atmosphere, and energy coupling between the ion species were obtained. Solutions to the energy equations for three models of the neutral atmosphere indicate that the H^+ and He^+ ion temperatures are higher than the O^+ temperature in the regions between 250 and 650 km. A peak temperature difference greater than two hundred degrees occurs for H^+ and O^+ ions, while values which may reach one hundred degrees are noted for the He^+–O^+ separation. The temperature inequality is explained in terms of the atmospheric and ionospheric conditions, showing that the altitude extent of ion temperature separation increases for rising thermospheric and electron temperatures and decreases for progressively larger electron densities. Author

N67-11856*# National Bureau of Standards, Washington, D. C.
IONOSPHERIC E-REGION IRREGULARITIES PRODUCED BY NON-LINEAR COUPLING OF UNSTABLE PLASMA WAVES
J. P. Dougherty (Cambridge Univ., England) and D. T. Farley (Jicamarca Radar Obs., Peru) [1966] 49 p refs Submitted for Publication
(NASA Order R-83)
(NASA-CR-79926) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The irregularities responsible for the strongest VHF echoes from the equatorial E-region and the aurora appear to have been adequately explained as arising from a form of two-stream plasma instability. Many of the weaker features of the echoes from the electrojet irregularities cannot be explained on this basis, however. The waves generated by the instability will grow in amplitude until they are limited by non-linear effects. These effects, furthermore, will cause coupling between waves which will generate new waves that cannot be directly excited. In the present paper we show that scattering from such secondary irregularities can account for many of the weak features of the VHF echoes. The theory is only qualitative, but the agreement between its predictions and most of the experimental observations is quite good. Author

N67-11879 Defence Research Telecommunications Establishment, Ottawa (Ontario).
ALOUETTE 1 IONOSPHERIC DATA, ALOSYN, 1 JANUARY–15 JANUARY 1964
1 Aug. 1966 127 p
CFSTI: HC $4.00/MF $0.75

Topside ionospheric parameters are presented from Alouette I satellite ionograms. Selected synoptic data are listed in the order in which the ionograms were recorded, one tabulation row for each ionogram. A.G.O.

N67-11880 Defence Research Telecommunications Establishment, Ottawa (Ontario).
ALOUETTE 1 IONOSPHERIC DATA, ALOSYN, 16 JANUARY–31 JANUARY 1964
1 Aug. 1966 133 p
CFSTI: HC $4.00/MF $1.00

Alouette topside sounder synoptic data, consisting of selected ionospheric parameters obtained from Alouette I ionograms, are presented. The parameters are listed in the order in which the ionograms were recorded, one tabulation row for each ionogram. The parameters are tabulated for all sounder data recorded during this period of time at various telemetry stations located throughout the world. A.G.O.

N67-11916# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
EXPERIMENTAL ANALYSIS OF THE INFRARED CONTRAST BETWEEN EARTH AND SPACE [ANNALYSE EXPERIMENTALE DU CONTRASTE INFRAROUGE ENTRE LA TERRE ET L'ESPACE]
Andre Girard 1966 22 p refs In FRENCH Presented at the 7th Intern. Symp. on Space Sci. (COSPAR), Vienna, 11–15 May 1966
(TP-350(1966)) CFSTI: HC $1.00/MF $0.50

As part of an experimental study of the transition of the emissivity zone between earth and space, a widespread radiation was observed to take place at night. Its spectral band was between 1 and 35 μ and its angular resolution limit was 0.16°. Measurements of the infrared contrast were made while a capsule, with a device to control attitude, was at an altitude between 80 and 182 km. The experiment and materials used are described, and the results are compared with those obtained by a theoretical study on an atmospheric model. Transl. by M.W.R.

N67-11937# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ROCKET MEASUREMENTS OF UPPER ATMOSPHERE DENSITY AND TEMPERATURE OVER FORT CHURCHILL, MANITOBA
Robert N. Grenda Sep. 1966 183 p refs
(Grants AF-AFOSR-276-66; NRC-SRA-1)
(UTIAS-117; AD-639607) CFSTI: HC $5.00/MF $1.00

The report describes a rocket experiment designed to measure density and molecular scale temperature above 100 km by means of a free molecule flow analysis of the data. In addition, pressure, temperature, and density were measured in the lower atmosphere by conventional methods. A theoretical analysis under conditions of continuum and free-molecule flow is included. The desired atmospheric parameters are given in terms of the quantities measured by the rocket-borne instruments. The mechanical design of the payload, and the electronics and electrical system are discussed. The data is reduced and the atmospheric parameters based on the data are presented. The experiment is discussed and modifications are suggested to improve the experiment and obtain better data Author (TAB)

N67-11947*# Texas Univ., Austin.
LABORATORY STRESS-DEFORMATION CHARACTERISTICS OF SOILS UNDER STATIC LOADS
Osman I. Ghazzaly and Raymond F. Dawson Washington, NASA, Oct. 1966 191 p refs
(Grant NsG-604)
(NASA-CR-571) CFSTI: HC $3.25/MF $1.00 CSCL 08M

A study of the laboratory stress-deformation characteristics of soils was performed. The first part includes a thorough literature survey of the subject. The factors believed to influence the stress-strain behavior of soils are presented. Based on a literature review, evaluation of available test equipment is made. The modulus of deformation and lateral strain ratio are suggested as the proper parameters describing stress-strain properties of soils. The second part of the investigation covers a laboratory study of stresses, strains, modulus of deformation, and lateral strain ratio for dry sands and saturated clays under various conditions. Also, a correlation is suggested among the moisture content, cohesion, and plasticity of normally-consolidated clays. A procedure for measuring lateral deformations of vacuum triaxial test specimens of dry sand, and unconfined clay samples, using extensometers is also outlined. Author

N67-11984*# Pennsylvania State Univ., University Park.
A COMPARISON OF FPS-16 AND GMD-1 MEASUREMENTS AND METHODS FOR PROCESSING WIND DATA. PHASE II: ANALYSIS OF TIME VARIABILITY OF ATMOSPHERIC PARAMETERS Final Report
E. F. Danielsen and R. T. Duquet 28 Nov. 1966 66 p refs
(Contract NAS8-11145)
(NASA-CR-61158) CFSTI: HC $3.00/MF $0.50 CSCL 04A

A machine method for computing winds from GMD-1 tracking and radiosonde data is developed and tested. The test includes a direct comparison of balloon ascent rates, horizontal wind speeds and directions with those computed from precision FPS-16 radar tracking data. In each of five cases tested, the GMD and radar measurements were made simultaneously by tracking the same effective target, i.e., a radiosonde transmitter and the chaff filled

balloon which carried it aloft. The method accurately reproduces the macroscale and mesoscale features of the wind speed profiles and vector hodographs when the elevation angles are greater than ten degrees. The winds computed from the FPS-16 measurements contain, between the earth's surface and the maximum altitude reached by the radiosonde balloon, many oscillations in wind speed and direction. The hodographs suggest that the velocities can be decomposed into a mean wind vector and a perturbation vector which rotates cyclonically or anticyclonically with height. Author

N67-12001# Joint Publications Research Service, Washington, D. C.

SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 144

16 Nov. 1966 91 p refs Transl. into ENGLISH from Russian
(JPRS-38677; TT-61-11147-144) CFSTI: $3.00

Reported is an annotated bibliography of Soviet-Bloc research in astronomy, meteorology, oceanography, terrestrial geophysics, and upper atmospheric and space science. S.C.W.

N67-12003# Joint Publications Research Service, Washington, D. C.

USE OF ARTIFICIAL EARTH SATELLITES FOR GEODESY

A. P. Polezhayev 8 Nov. 1966 33 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Geod. i Aerofotos. (Moscow), no. 2, 1966 p 27–48
(JPRS-38537; TT-66-34962) CFSTI: $2.00

Discussed is the use of non-geodetic and geodetic earth satellites for solving geometrical problems associated with determining absolute or relative positions of points on the earth's surface and dynamic problems associated with determining the dimensions and form of the earth. Included is a review of several geodetic satellites which are being developed abroad. S.C.W.

N67-12012# Joint Publications Research Service, Washington, D. C.

CONDITIONS OF THE FORMATION OF PARTICLES OF RADIOACTIVE FALLOUT AND FRACTIONING OF ISOTOPES IN AN UNDERGROUND NUCLEAR BURST WITH THE ESCAPE OF GASES FROM THE GROUND

Yu. A. Izrael' 22 Nov. 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 169, no. 3, 21 Jul. 1966 p 573–576
(JPRS-38744; TT-66-35168) CFSTI: $1.00

Presented are estimates of changes in volume, pressure, and temperature in an alluvium cavity (of the Sedan type) pierced by a 100-kilotron nuclear shot with a reduced depth of 50 m/kt 1/3.4. Compared are differences in the formation of particles of radioactive fallout and isotope fractionation occurring after underground, ground, and air bursts. S.C.W.

N67-12020# Chicago Univ., Ill. Dept. of the Geophysical Sciences.

THE APPLICATION OF VARIANCE SPECTRUM ANALYSIS TO CLOUD MEASUREMENTS

Bernice Ackerman 1 Oct. 1966 62 p refs
(Grants NSF G-22292; NSF GP-3881)
(TN-34)

The application of variance spectrum analysis techniques to continuous measurements obtained in clouds is discussed. These methods were chosen for a study to determine if the space variations observed in clouds were random or whether they reflected sub-cloud scales of activity. The reasons for choosing spectrum analysis over other methods, the problems encountered, and details of the computational methods are described in detail. Spectrum analysis is shown to by a useful tool in research concerned with the turbulent characteristics of clouds. It is a convenient means of handling large amounts of data and results in a rather simple description to which an estimate of reliability can be ascribed. Most of the problems which arise in its application to cloud data hinge on the fact that the data series are usually short because of the relatively small size of the cloud area. The biggest problem in using spectrum analysis arises in interpreting the spectra. Factors such as computational or data reduction methods, characteristics of the measuring instrument, and mode of collection may affect the spectra. However, used with caution spectrum analysis may yield significant physical information as to small scale cloud structure. R.N.A.

N67-12069# Bureau of Mines, Denver, Colo. Mining Research Center.

A COMPUTER METHOD OF FITTING SURFACES TO ASSAY AND OTHER DATA IN THREE DIMENSIONS BY QUADRATIC-REGRESSION ANALYSIS

Richard F. Link (Princeton Univ.), Norman N. Yabe, and George S. Koch, Jr. 1966 37 p refs
(BM-RI-6876)

A statistical technique, useful to analyze assay and other data characterized by location in three dimensions, is described. If present, trends in the data are defined for the purposes of improving ore estimation, predicting ore beyond existing workings, and aiding geological interpretation. The technique is to fit linear and quadratic polynomial equations to the data through the statistical method of regression analysis. The fitted linear equations have the geometric form of hyperplanes; the fitted quadratic equations have the geometric form of ellipsoids or elliptic hyperboloids of one or two sheets. To visualize these three-dimensional forms, contour maps of a series of plane sections through the fitted surfaces are plotted. Both the fitting of the polynomial equations and the plotting of the contour maps are done by electronic computer to facilitate calculations and to obtain accurate results. Computer programs are described in appendixes. Methods employed are illustrated by an example analysis, based on data from a part of the Fresnillo mine, Zacatecas, Mexico. Author

N67-12193# Army Engineer Research and Development Labs., Fort Belvoir, Va.

PRELIMINARY EXPERIMENTS FOR CRATER MODELING IN CONTROLLED SOIL MEDIA Interim Technical Report, 22 Apr.–11 Nov. 1964

George Gornak Jun. 1966 87 p refs
(Rept.-1862; AD-639146) CFSTI: HC $3.00/MF $0.75

The report covers a series of 30-gram, high-explosive cratering tests performed to determine effect soil moisture content in relation to the soils plastic limit has on craters, ground shock velocities, residual displacements, and rarefaction wave. The report concludes: (a) In a cohesive soil the moist condition (moisture content within the plastic index) as contrasted with the dry condition (moisture content well below the plastic limit) influences crater formation in the following ways. (1) Fallback into the crater is reduced so that apparent and true crater dimensions are identical. (2) The profile of the crater is more symmetrical and parabolic in shape. (3) The ejecta which consist of large clods, for the most part, are distributed near the crater lip. (4) The crater parameters of depth, diameter, and especially volume are considerably increased. (5) Attenuation rate of the shock velocity is lessened appreciably and results in higher shock velocities and pressures at greater distances from the center of the charge. (6) Larger soil displacements are obtained at any given distance from the center of the charge. (7) The possibility exists that a substantial increase in residual radiation may result from the lack of fallback material. (b) Large-scale results in marine muck and silty sand compared with results of this study reveal similarity in crater form. This suggests a general hypothesis that any soil which has moisture content that approaches the plastic limit will exhibit similar behavior Author (TAB)

N67-12226*# Geophysics Corp. of America, Bedford, Mass. Technology Div.
ATMOSPHERIC DENSITY MODELS AND OBSERVATIONS Status Report
R. A. Minzner. Feb. 1966 35 p refs
(Contract NASw-1226)
(NASA-CR-79307; GCA-66-5-N) CFSTI: HC $2.00/MF $0.50 CSCL 04A

The vast amount of satellite drag-acceleration data acquired from the measured orbits of artificial earth satellites above 200-km altitude over the past nine years has led to the recognition that at high altitudes, at least, the atmosphere varies greatly with time; that is, from day to night as well as from periods of high solar activity to periods of low solar activity. Several models reflecting these variations have been developed, and these indicate a shift in thinking away from the concept of a single average model to that of the multiple model showing variability. During this same nine-year period the number of observations of atmospheric properties below 120-km altitude has also increased considerably, though not nearly at the same rate as those above 200 km. Models showing seasonal and latitudinal variations below 120 km have been prepared—some on the basis of rather limited data. These models suggest an isopycnic region at about 90 km with a density about 14 percent greater than that of the 1962 United States Standard Atmosphere at that altitude. These models also suggest seasonal variability to be minimum at tropical latitudes and to increase to maximum at sub-polar latitudes. No diurnal variation has yet been suggested at altitudes below 120 km. Author

N67-12268*# Bureau of Mines, Minneapolis, Minn. Twin Cities Mining Research Center.
MULTIDISCIPLINARY RESEARCH LEADING TO UTILIZATION OF EXTRATERRESTRIAL RESOURCES Quarterly Status Report, 1 Jul.–1 Oct. 1966
1 Oct. 1966 32 p refs
(NASA Order R-09-040-001)
(NASA-CR-80121) CFSTI: HC $2.00/MF $0.50 CSCL 08G

Physical work in multidisciplinary research on extraterrestrial resources centered on the following topics: background information analysis on rocks that simulate the range of materials most likely to be found on a lunar surface; sample collection and physical properties of simulated lunar materials; gas adsorption and outgassing of one-inch cube of semiwelded tuff in a vacuum system; static and dynamic properties of simulated lunar materials and rocks; classification of ground silica into six selected particle size bands; development of bombproof laboratory facility for electronic and optical instrumentation; literature search on volcanism and ore genesis as related to lunar mining; determination of reduction rate of silica with carbon; equipment development for vacuum contact electrification of minerals; pressure tests on sulfuric acid; and other related subjects. G.G.

N67-12274*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPLORER 12 MEASUREMENTS OF THE DISTORTION OF THE GEOMAGNETIC FIELD BY THE SOLAR WIND
Gilbert D. Mead and Laurence J. Cahill, Jr. (New Hampshire Univ.) Nov. 1966 29 p refs Submitted for Publication
(NASA-TM-X-55622; X-640-66-527) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Magnetometer data from 7 passes of Explorer 12 during quiet times have been compared with theoretical magnetosphere models. The data cover the region from 3-1/2 to 13 earth radii and are expressed in terms of the deviation in field magnitude from a Jensen and Cain reference field, plus inclination and declination angles measured with respect to the dipole axis. Near the noon meridian and from 8–7 earth radii out to the magnetopause, the magnitude and direction of the observed field seem to agree quite well with those predicted by the distorted magnetosphere model of Mead and Beard. Near the dawn meridian, a significant twisting of the field lines out of the dipole magnetic meridian plane is observed, corresponding to the tendency of the field to point in the antisolar direction in the southern hemisphere. From 3-1/2 to 7 R_E there is strong evidence of quiet-time plasma currents tending to inflate the field. In particular, the field magnitude dips well below the Jensen and Cain values at around 3-1/2 R_E close to the geomagnetic equator. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N67-11256# Army Electronics Labs., Fort Monmouth, N. J.
SOLID-STATE ELECTROMETER FOR PORTABLE RADIATION MONITOR
Joseph C. Nirschl Aug. 1966 23 p refs
(ECOM-2736; AD-639587) CFSTI: HC $1.00/MF $0.50

A solid-state electrometer is described in which a Metal-Oxide Semiconductor Field Effect Transistor (MOS FET) is employed in the high impedance input stage. The range of current measurement is from 10 to the −12th power Amperes to 10 to the −8th power Amperes. The design of this electrometer lends itself to application in a portable radiation survey meter, affording high linearity, fast response, instant warm-up, and low power consumption.
Author (TAB)

N67-11284*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENTIFIC INSTRUMENT DESIGN AND INTEGRATION
Benjamin A. Waltman *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 17–32 (See N67-11281 02-31) CFSTI: HC $3.00/MF $0.75

The complex problems of space instrument design and integration are studied for fixed and moving instrument look angles. Point-to-point trajectory coordinates in space for a point mass are used to generate design data and to establish the relation of trajectory coordinates and local space guidance with a spacecraft. Examples of mechanical design problems for a standard electronic module, a microwave radiometer, and an ultraviolet spectrometer are presented. G.G.

N67-11322*# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.
STUDIES RELATED TO THE DESIGN OF A MAGNETIC SUSPENSION AND BALANCE SYSTEM Interim Technical Report, Dec. 1964–Jan. 1966
V. V. Basmajian, A. B. Copeland, and T. Stephens Feb. 1966 231 p refs
(Contract NAS1-4421)
(NASA-CR-66233; ITR-128) CFSTI: HC $3.75/MF $1.25 CSCL 14B

The basic design principles of a relatively interaction-free five-component magnetic suspension and balance system are described. The performance of the various subsystems are described in detail. Several recent innovations in subsystem design are outlined. The results of the study are applied to a proposed design of a complete magnetic suspension and balance system to be compatible with the fifteen-inch hypersonic flow apparatus. Author

N67-11341*# Spacelabs, Inc., Van Nuys, Calif.
EVALUATION OF A MINIATURIZED DOUBLE-FOCUSING MASS SPECTROMETER

Wayne H. Brigden. Washington, NASA, Nov. 1966. 195 p. refs
(Contract NAS4-791)
(NASA-CR-605) CFSTI: HC $3.25/MF $1.00 CSCL 20F

A miniaturized magnetic double-focusing mass spectrometer was evaluated as a practical means of measuring gas concentrations in a flight environment. The evaluation results are summarized, including sensitivity, minimum detectable level, accuracy, long term stability, input pressure, mass range, resolution, output, unattended operating time, and response time. Details are given on the basic theory of operation, laboratory layout and equipment, vacuum system, ion source, analyzer evaluation, and evaluation of the electronics. It was concluded that the mass spectrometer examined is feasible, and it was pointed out that it has several inherent advantages over other means of gas concentration measurement: the capability of simultaneously monitoring several gases, the capability of scanning for unknown gases, and the ability to obtain accurate readings in a tenth of a second or less. L.E.W.

N67-11394*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MONITORING SYSTEM FOR SYNOPTIC OBSERVATIONS OF JOVIAN AND SOLAR DECAMETER-WAVE RADIO EMISSIONS
J. K. Alexander. Oct. 1966. 38 p. refs
(NASA-TM-X-55611; X-615-66-496) CFSTI: HC $2.00/MF $0.50 CSCL 03A

A simple decameter-wave monitoring system designed to provide synoptic observations of the sporadic radio emission from Jupiter is described. The network is composed of five stations located around the world so as to provide continuous coverage of Jupiter with identical instruments. A pair of two-element lobe-sweeping interferometers operating at 16.7 and 22.2 MHz comprise each station. To illustrate the performance of the system, results of observations during the 1965 apparition of Jupiter are presented. Author

N67-11705# Battelle-Northwest, Richland, Wash.
A PRECISION LONG COUNTER FOR MEASURING FAST NEUTRON FLUX DENSITY
J. De Pangher and L. L. Nichols. Jun. 1966. 62 p. refs
(Contract AT(45-1)-1830)
(BNWL-260) CFSTI: HC $3.00/MF $0.75

A reproducible version of the Hanson–McKibben long counter was built and a comprehensive experimental investigation of its characteristics was made. The counter is made carefully from polyethylene and strengthened with aluminum instead of being paraffin strengthened with steel. It is called a precision long counter (PLC) because models built from a standard set of drawings have closely reproducible properties. Data are given to show how a PLC can be calibrated to within 1% for measuring neutron flux densities from radioactive sources. This calibration is obtained with a small calibrated PuBe neutron source inserted inside the PLC. The standard counter, H-1, is located at Battelle-Northwest in Richland, Washington and the standard small source, M-1045, is located at Mound Laboratory in Miamisburg, Ohio. One counter, H-3, was selected as a roving counter, was calibrated against H-1, and was sent to the Mound Laboratory and to the Argonne National Laboratory to calibrate the two counters, ML-1 and ANL-1. The problem of using a PLC with accelerator neutrons is discussed and a solution offered. Author (NSA)

N67-11711# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
A PORTABLE MULTIPURPOSE RADIATION MONITOR
William F. Splichal, Jr. May 1966. 13 p. ref
(Contract AT(07-2)-1)
(DP-993) CFSTI: HC $1.00/MF $0.50

A basic electronic package for a portable multipurpose radiation monitor was designed, fabricated, and field tested. Transistorized plug-in circuits powered by rechargeable nickel-cadmium batteries, a readout meter, and an electromechanical register are contained in a 4"×5"×8" case. Three rate meter ranges, a battery check position, and a register integrator for low rates are provided. The circuitry contains seven silicon transistors on four plug-in cards. Neutron, alpha, beta–gamma, or alpha–beta–gamma detectors can be individually coupled to the electronic package. Calibration for each detector is simple and stable because the package is unaffected by temperature changes between 20° and 100°F. The monitor weighs about seven pounds, can be carried in one hand, requires no warmup period, and is easy to operate and service. Author (NSA)

N67-11723*# Mississippi State Univ., State College. Dept. of Physics.
MICROWAVE SPECTROSCOPIC IDENTIFICATION OF ATMOSPHERIC CONTAMINANTS Status Report, Apr. 1–Sep. 30, 1966
Gordon E. Jones. Oct. 1966. 21 p. refs
(Grant NGR-25-001-008)
(NASA-CR-79490) CFSTI: HC $1.00/MF $0.50 CSCL 20F

This investigation aims to employ the unique features of microwave spectroscopy as a simple and direct means for the identification of small amounts of trace gases. As a first step, the microwave spectra of gases which might possibly contaminate the atmosphere of a space capsule were catalogued, and the results of this study are presented as a bibliography of inorganic and organic molecules. In addition, a sweep oscillator spectrometer that is to be used in the investigations is described in detail. K.W.

N67-11817*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RANGER VII PHOTOGRAPHIC PARAMETERS
W. E. Kirhofer and D. E. Willingham. 1 Nov. 1966. 314 p. refs
(Contract NAS7-100)
(NASA-CR-79938; JPL-TR-32-964) CFSTI: HC $4.25/MF $1.50 CSCL 14E

Photographic parameters necessary for detailed interpretation of the Ranger VII pictures are listed for all of the A- and B-camera photographs and for selected P-camera photographs. Parameter accuracies and the method of data generation are discussed. Author

N67-11818*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RANGER VIII PHOTOGRAPHIC PARAMETERS
W. E. Kirhofer and D. E. Willingham. 1 Nov. 1966. 114 p. refs
(Contract NAS7-100)
(NASA-CR-79938; JPL-TR-32-965) CFSTI: HC $3.00/MF $0.75 CSCL 14E

Photographic parameters necessary for detailed interpretation of the Ranger VIII pictures are listed for selected photographs, including all photographs published in the Ranger VIII atlases. Parameter accuracies and the method of data generation are discussed. Author

N67-11848*# Geological Survey, Washington, D. C.
DISPERSIVE MULTISPECTRAL SCANNING: A FEASIBILITY STUDY Technical Letter NASA-65
J. Braithwaite (Michigan Univ.) Nov. 1966. 61 p. refs
(NASA-Order R-148)
(NASA-CR-79916) CSCL 17H

Optical-mechanical line scanners can be used from aircraft and satellites to obtain strip maps of the surface over which the vehicle passes. The feasibility of combining wavelength dispersing techniques with such scanning techniques has been studied. This combination makes it possible to obtain spectral and spatial information simultaneously. Appropriate data processing techniques will then permit us to interpret the spectral data to produce surface maps of various kinds, such as maps of crop type or of surface geology. Parametric equations representing a generalized dispersive

multispectral scanner are developed and discussed in the light of subsystem and component state of the art and from the point of view of prospective users such as geologists and agriculturalists. Author

N67-11871# Weapons Research Establishment, Salisbury (Australia).
PROJECT EUROPA I TELEVISION MONITORING SYSTEM FOR LAUNCHER AREA 6
M. W. Woods Aug. 1966 15 p
(WRE-256, Issue 2) CFSTI: HC $1.00/MF $0.50

The work that is necessary to provide an adequate television monitoring system at Launcher Area 6 for phases 2 and 3 of the EUROPA 1 Project is defined. Existing cameras are briefly reviewed, and modifications and extensions to the system are specified. The modifications involve video switching and a two monitor presentation at a number of locations. Extensions include three additional cameras as well as monitoring facilities for the Overall Team Leader, the Second Stage Team Leader, and the third Stage Team Leader. A.G.O.

N67-11910# Aeronautical Research Labs., Melbourne (Australia).
BEHAVIOUR OF ATTACHED AND UNATTACHED FOIL RESISTANCE STRAIN GAUGES
I. G. Scott and I. R. Hockley Nov. 1965 23 p refs
(ARL/SM-299) CFSTI: HC $1.00/MF $0.50

Behavior of a group of foil gauges in the attached and unattached states is reported. Parameters associated with the unattached gauge, and their relation to the temperature coefficient of resistance of the attached gauge, were examined. Some correlation between the attached and unattached temperature coefficient was found. An additional factor in the temperature coefficient equation for the unattached gauge was introduced. Author

N67-11917# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
ANALOGIC DEVICE FOR STATISTICAL MEASUREMENTS OF CORRELATION IN TIME [APPAREIL ANALOGIQUE DE MESURES STATISTIQUES DE LA CORRELATION DANS LE TEMPS]
Alexandre Favre and Jean Gaviglio 1966 33 p refs In FRENCH Presented at the Colloq. on the Statist. Treat. of Measurement, Grenoble, France, 26–29 Apr. 1966
(TP-361(1966)) CFSTI: HC $2.00/MF $0.50

An analog device for measuring statistical correlation in time is considered applicable to the study of many uncertain stationary phenomena, particularly the turbulence seen in fluid mechanics. Principle and development of the device are discussed; details are given for applications to turbulent fluids in subsonic and supersonic flow, as well as for use in studying results obtained by electrocardiograms. For the latter, two methods are reviewed for extracting an extraneous noise from a periodic signal; the first uses correlation in time while the second reduces the stray current by including a delay mechanism. Transl. by M.W.R.

N67-11928# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
LUNAR BIAXIAL POINTING CONTROL. Final Report, 1 Apr. 1960–31 Aug. 1965
Frank E. Wise, Fred C. Wilshusen, Vernon Stone, and Robert Mason Feb. 1966 45 p
(Contract AF 19(604)-7293)
(AFCRL-66-102; AD-637842) CFSTI: HC $2.00/MF $0.50

Optical electronic devices, similar to the Aerobee Solar Pointing Control (See PB-153 442 or AD-247 034), were designed, fabricated and tested to orient rocket-borne lunar spectrographs toward the moon with a pointing accuracy of 15 minutes of arc, or less. Author (TAB)

N67-11929# Massachusetts Inst. of Tech., Cambridge. Dept. of Geology and Geophysics.
AN ON-THE-BOTTOM SEA GRAVIMETER
Charles Goddard Wing (Ph.D. Thesis) 1 Jun. 1966 219 p refs
(Contract Nonr-1841(74))
(AD-639198) CFSTI: HC $6.00/MF $1.25

90% of the ocean floor lies beyond the reach of present marine gravimeters. For features with dimensions of the same order as the water depth, resolution demands an on-the-bottom profile. An inertial guidance component was adapted to measure gravity automatically in a free-fall, on-the-bottom vehicle. By special techniques, an accuracy in the range 1–2 mgal was obtained under preliminary operating conditions. Author (TAB)

N67-11941 Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
INSTRUMENTATION FOR HIGH SPEED PLASMA FLOW
Allen E. Fuhs New York, Gordon and Breach Sci. Publishers, 1965 188 p refs Sponsored by AF
(AGARDograph-96)

Discussed are principally electrodeless instruments which use magnetic or electromagnetic fields to probe plasmas. A survey on electrostatic probes is given and the individual characteristics of a plasma sheaths surrounding a reentry vehicle, rocket exhaust flows, ballistic ranges and magnetohydrodynamic generators are related to different instrumentation and design theories. Diagnostic instruments for determining both macroscopic and microscopic plasma properties are described and illustrated. Included are tables on magnetohydrodynamics and plasma formulae and plasma constants and conversion factors. G.G.

N67-11951*# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
STUDY OF LUNAR, PLANETARY, AND SOLAR TOPOGRAPHY First Phase Report, 1 Jul. 1965–15 Apr. 1966
C. E. Campbell Washington, NASA, Nov. 1966 130 p refs
(Contract NAS12-19; Proj. Tech Top)
(NASA-CR-650) CFSTI: HC $3.75/MF $1.00 CSCL 03A

This report presents the results of the first phase of a program to assess the state of the art in topographic information collection systems for application to the space program. The method of acquisition that may apply for lunar, planetary and solar surfaces are described. A detailed investigation of the stereo imagery method is reported including requirements, sensors and errors involved. The applicability of holographic methods is evaluated with the most promising application concluded to be in the area of image enhancement. The transmission and display of three-dimensional information are examined in terms of requirements and methods. Other subjects surveyed include the peculiar problems of changing solar topography, measurements to test the general theory of relativity and measurement of stellar parallax from a space vehicle. Conclusions and recommendations for improving the state of the art, where possible, are given. Numerous references are included. Author

N67-11969*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTINUITY GAGE MEASUREMENT OF CRACK GROWTH ON FLAT AND CURVED SURFACES AT CRYOGENIC TEMPERATURES
Timothy L. Sullivan and Thomas W. Orange Washington, NASA, Dec. 1966 23 p refs Presented at the ISA 3rd Ann. Phys. and Mech. Meas. Instrumentation Symp., New York, 24–27 Oct. 1966
(NASA-TN-D-3747) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A method for measuring instantaneous crack length with a multiple-element foil continuity gage is described. The gage is of particular use in measuring plane-stress crack growth on curved surfaces and at cryogenic temperatures. In order to interpret the output of the gage properly, an experimental calibration program was conducted with through-center-notched aluminum alloy (2014-T6

aluminum), extra-low-interstitial (ELI) titanium alloy (Ti-5Al-2.5 Sn), and stainless-steel (AISI 301) flat-sheet specimens at temperatures to −423°F. The calibration program also included through-cracked aluminum alloy cylinders pressure cycled at −320° and −423°F. The experimental calibration program showed that the technique used in mounting the gage was critical in obtaining proper operation. In some cases, the fracture of a gage element was caused by the high plastic strain at the crack tip and not to the crack growing through the element. An analytical expression was used to take into account this plastic strain and to minimize the number of test specimens required for an accurate calibration. Author

N67-11980# Gt. Brit. Ministry of Aviation, London.
A SMALL EIDOPHOR FOR THE PROJECTION OF BLACK AND WHITE TELEVISION PICTURES [KLEINEIDOPHOR FUER FERNSEHGROSSPROJEKTION IN SCHWARZ-WEISS]
E. Gretener Sep. 1966 7 p Transl. into ENGLISH from Elektrizitaetsverwertung (Germany), v. 33, no. 6/7, 1958 p 172–178
(TIL/T-5677) CFSTI: HC $1.00/MF $0.50

The problem relates to the projection of television pictures onto large screens. The conventional method using the Schmidt optical system gives poor contrast and lack of brilliance. With the eidophor, dark field projection is used with an external light source to recreate each point of the picture source. A thin film of oil electrostatically activated to produce ripples of varying amplitude is the intermediary medium for light transfer. Ratios of 100/1 contrast are possible. Modifications to the basic system are described for this new model. Author

N67-12063*# Michigan Univ., Ann Arbor. Radio Astronomy Obs.
ENGINEERING FEASIBILITY STUDY OF A KILOMETER WAVE ORBITING TELESCOPE, PHASE I Final Report
Fred T. Haddock Oct. 1966 628 p refs
(Grant-23-005-131)
(NASA-CR-79734) CFSTI: HC $9.27/MF $2.75 CSCL 17H

Objectives, operational requirements, structural dynamics, and radio telescope antenna feasibility studies for the Kilometer Wave Oribiting Telescope (KWOT) are reported. Favorable mission objectives and engineering feasibility are recorded. Electrical power and weight estimates for the system are listed. Numerous details in 13 appendixes cover: KWOT dynamics, stable configurations in force-free rotational motion, small maneuvering subsatellite, spinning spring-mass in orbit, rhombic antenna perturbation, resistive cylindrical antenna, and synthetic antenna system research. R.L.

N67-12054*# Chrysler Corp., New Orleans, La. Space Div.
OPTICAL TECHNOLOGY APOLLO EXTENSION SYSTEM, PART I. VOLUME (1 OF 2). SECTION 1:
21 Oct. 1966 292 p refs
(Contract NAS8-20256)
(NASA-CR-79503) CFSTI: HC $6.00/MF $1.50 CSCL 17H

Proposed, as well as discarded, optical technology developments are reported for the Optical Technology Apollo Extension System (OTAES). Technological advancements are listed for projects in astronomy, meteorology, earth remote sensing, and communications. Numerous experimental details are given for: optical heterodyne detection both onboard spacecraft and on earth, direct detection space to ground, 10 MHz bandwidth, precision tracking of a ground beacon, loop closures, and transfer tracking from one ground station to another. R.L.

N67-12055*# Chrysler Corp., New Orleans, La. Space Div.
OPTICAL TECHNOLOGY APOLLO EXTENSION SYSTEM, PART I. VOLUME 1 (2 OF 2). SECTION 1: INTRODUCTION. SECTION 2: EXPERIMENT DEVELOPMENT Final Technical Report
21 Oct. 1966 441 p
(Contract NAS8-20256)
(NASA-CR-79499) CFSTI: HC $4.90/MF $2.00 CSCL 17H

Systems integration techniques are listed for the Optical Technology Apollo Extension System (OTAES). Numerous technical details are supplied on the following experiments: phase correlation and pulse distortion measurements, primary mirror figure test and correction, thin mirror nesting principle, fine guidance, comparison of isolation techniques, interferometer system, segmented optics, spectrograph development, baffles comparison, atmospheric absorption experiments, photon-photon scattering, remote manual optical alignment, visual tracking rating, cryogenic cooling, photo-electro-optical experiment, and mirror coating. Potential and discarded OTAES experiments are also reported. R.L.

N67-12056*# Chrysler Corp., New Orleans, La. Space Div.
OPTICAL TECHNOLOGY APOLLO EXTENSION SYSTEM, PART I. VOLUME II. SECTION 3: SYSTEMS INTEGRATION Final Technical Report
21 Oct. 1966 355 p refs
(Contract NAS8-20256)
(NASA-CR-79497) CFSTI: HC $7.00/MF $1.75 CSCL 17H

The systems integration of optical technology experiments in support of an overall technology development program is reported. The Optical Technology Apollo Extension System (OTAES) experiments are detailed for: manning and orbital requirements; optical propagation; telescope requirements for one meter, strapped down, gimballed, and fine guidance telescopes; OTAES mission, as well as candidate and recommended missions; mission constraints; ground station concepts; supporting spacecraft subsystems; recommended and candidate spacecraft concepts; structural and mechanical concepts; stabilization and control; power capability; environmental control; and mission time phasing. A typical OTAES subsystem component summary is included. R.L.

N67-12057*# Chrysler Corp., New Orleans, La. Space Div.
OPTICAL TECHNOLOGY APOLLO EXTENSION SYSTEM, PART I. VOLUME III. SECTION 4:
21 Oct. 1966 70 p
(Contract NAS8-20256)
(NASA-CR-79524) CFSTI: HC $3.00/MF $0.50 CSCL 17H

Definitive details are reported on the Optical Technology Apollo Extension System (OTAES) technology development plan. Concepts are outlined on the following topics: general problems, path of evolution of the solution, relationship of OTAES experiments to technology problem area, prerequisite technology activities, experiment development and master planning schedules, experiment integration and availability. The requirements for the onboard testing of an astronomically oriented telescope are listed. R.L.

N67-12058*# Chrysler Corp., New Orleans, La. Space Div.
OPTICAL TECHNOLOGY APOLLO EXTENSION SYSTEM, PART I Summary Report
21 Oct. 1966 84 p ref
(Contract NAS8-20256)
(NASA-CR-79521) CFSTI: HC $3.00/MF $0.50 CSCL 17H

For the Optical Technology Apollo Extension System (OTAES), summarized program data are presented on optical technology needs, major objectives development plan, systems integration, and the OTAES master planning schedule. Analytical details are reviewed for the following recommended experiments: optical heterodyne detection, 10 MHz bandwidth experiment, transfer tracking, primary correlation, pulse distortion, thin mirror nesting principle, fine guidance, stellar interferometer, and the segmented optics experiment. Thirty-four conclusions and thirty-three recommendations are included. R.L.

N67-12099*# National Aeronautics and Space Administration, Washington, D. C.
PRECAUTIONS IN USING THERMOBALANCES [PRECAUTIONS A PRENDRE DANS L'EMPLOI DES THERMOBALANCES]

C. Duval Sep. 1966 26 p refs Transl. into ENGLISH from Anal. Chim. Acta (France), v. 31, no. 4, 1964 p 301–314
(NASA-TT-F-10281) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Based on data obtained in the pyrolysis of numerous inorganic and organic substances in gravimetric analyses, studies on volumetric standards, and solid-state reactions, the differences in results obtained with various models of thermobalances are discussed. Ten main causes of such differences are given: type of apparatus, thermocouple, nature of substance, weight of substance, rate of heating, nature of ambient atmosphere, rate of flow of gas in the furnace, type and form of crucible, sensitivity of recorder tracings, and type and weight of residue. Standardization of these factors is discussed and optimum characteristics of the apparatus are described, giving preference to a balance with bifilar suspension.
Author

N67-12127*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PULSE HEIGHT ANALYZER MEMORY
W. J. Schneider *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 109–118 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Implementation of random access core memory, with 512 words and 18 bits in length, is discussed for a space-borne pulse height analyzer. The memory unit is described; and its hysteresis loop, inhibit winding, and address system are illustrated. The drive mechanism, organization of the wiring, and core stack geometry are described. Circuit details are included for the address register, decoding current drivers, sense amplifier, data register, inhibit driver, strobe generator, and power switching. Since the memory does not include internal programming, all required timing sequence signals must be provided by the pulse height analyzer or other equipment. A simple and versatile read–add one–write cycle is described, and timing of the memory cycle and interface signals is illustrated. Power consumption and packaging of the unit are mentioned.
M.W.R.

N67-12135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TAPE RECORDER WITH INCREMENTAL PLAYBACK CAPABILITIES
E. Bahm *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 170–175 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A tape recorder with incremental playback capabilities was designed and tested for performance. Photographs of the breadboard recorder and of the capstan assembly are depicted; and a block diagram of the recorder electronics is presented. Results from the low and high recording density tests show that controlled incremental playback of a tape recorder is feasible. It was demonstrated that the complexity of the control electronics is not prohibitive for spacecraft applications, or for the power consumption. The error rate is higher than that of constant speed tape recorders, and the control electronics must be carefully adjusted, but this can be improved by using a slightly more sophisticated detection circuit. More than a thousand hrs of incremental operation were accumulated during the tests with no bearing or motor failure. The buffered tape recorder and tape recorders with flux sensitive playback heads are commented upon.
L.S.

N67-12162*# Kinelogic Corp., Pasadena, Calif.
HELICAL PACK TAPE RECORDER TRANSPORT Final Report
Graham S. S. Barr 25 Aug. 1966 23 p Prepared for TPL
(Contracts NAS7-100; JPL-951348)
(NASA-CR-80140) CFSTI: HC $1.00/MF $0.50 CSCL 14C

The design of an endless loop transport capable of handling 2000 feet of 1/2 inch magnetic tape is described. Progress is reported in the development of a technology for forming helical tape from standard tape, the analysis of the various possible transport configurations, and the problem definition phase of the model study work. The advantages of the helical tape format are related for a number of tape transport applications, and details of the model construction are discussed.
A.G.O.

N67-12210*# Bendix Corp., Southfield, Mich. Research Labs. Div.
PHOTOVISCOUS TECHNIQUE DEVELOPMENT. VOLUME I: THEORY AND EXPERIMENTS
F. M. Faubert 15 Jun. 1966 87 p refs
(Contract NAS8-5407)
(NASA-CR-79519; Rept.-3477, Vol. I) CFSTI: HC $3.00/MF $0.75 CSCL 14E

This project concerned the application of photoviscosity to experimental investigations of flow fields in fluid devices. Milling Yellow dye solutions were used in the experiments. The analytical relationships between the optical phenomena and two-dimensional flow kinematics were summarized and presented. Test equipment was developed for applying the photoviscous technique to a variety of transparent models simply and conveniently. The use of a rectangular channel model, integral with the fluid circulation system, was demonstrated as a calibration device for obtaining the optic response of the photoviscous liquid. The majority of the quantitative testing was performed using a vortex model with no tangential flow. A comparison was made of the radial distribution of the fluid deformation rate as determined (a) analytically, and (b) by photoviscous experiments. The agreement was poor, which is attributed to the low aspect ratio (depth-to-width ratio) of the model. The comparison demonstrated (a) the importance of the aspect ratio criterion, if quantitative determination of a flow field is of interest, and (b) the need for studying the three-dimensional stresoptic law for Milling Yellow dye solution to extend the utility of the technique. The combination of photoviscosity with high-speed motion picture photography was found to be a potentially valuable technique for studying the internal dynamic response times in fluid flow models. Several kinds of qualitative information obtainable, using photoviscosity, are described. Recommendations are made for adding rheological calibration to optical calibration of the working fluid to refine the photoviscous technique.
Author

N67-12211*# Bendix Corp., Southfield, Mich. Research Labs. Div.
PHOTOVISCOUS TECHNIQUE DEVELOPMENT. VOLUME II: PHOTOVISCOUS TEST STAND
F. M. Faubert 15 Jun. 1966 26 p For Abstract See N67-12210 02-14
(Contract NAS8-5407)
(NASA-CR-79520; Rept.-3477, vol. II) CFSTI: HC $2.00/MF $0.50 CSCL 14E

N67-12216*# New Hampshire Univ., Durham. Dept. of Physics.
THE UNIVERSITY OF NEW HAMPSHIRE MAGNETIC FIELD OBSERVATORY NUCLEAR MAGNETOMETER
Wendell Sawyer [1962] 59 p refs
(Contract NAS5-3043; Grant NsG-33-60)
(NASA-CR-79314; UNH-66-5) CFSTI: HC $3.00/MF $0.75 CSCL 18D

Described are theory and operational procedures for a magnetometer that utilizes magnetic moment and angular momentum resonance of the hydrogen nuclei to measure geomagnetic fields. It is established that the hydrogen nuclei will precess at approximately 2000 cps in a magnetic field intensity of about 0.5 oersted; polarization of the random orientation of nuclei in a liquid hydrocarbon sample, followed by abrupt removal of the magnetic field allows the nuclei to precess freely in the earth's magnetic field at a frequency directly proportional to the earth's magnetic field. This precessing signal is picked up, amplified, and fed into a preset digital counter for analysis. A block diagram of the complete nuclear magnetometer is shown that includes the associated counting equipment necessary for signal image display.
G.G.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N67-11245# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMOBILE INDUSTRY Selected Articles
6 Jun. 1966 33 p Transl. into ENGLISH from Avtomob. Prom. (Mashgiz), 1964 p 37–40, 45–47
(FTD-TT-65-1856; TT-66-62282; AD-639153) CFSTI: HC $2.00/MF $0.50

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N67-11246# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATIVE EFFECTIVENESS OF VARIOUS TYPES OF CHROMIUM COATINGS
P. I. Zemskov *In its* Automobile Ind. 6 Jun. 1966 p 1–16 refs (See N67-11245 02-15) CFSTI: HC $2.00/MF $0.50

Dense chromium coating after knurling possesses good antifriction properties. Dense coating after knurling has high wear resistance and wears off little of the surface conjugated with it. Dense coating protects the detail against corrosion. The process of dense chromium plating after knurling is technologically simple, while the process of porous chromium plating is carried out by a strictly definite regime and the slightest deviations from same lead to a reduction in antifriction and wear resistant properties of the given coating. Author (TAB)

N67-11247# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH ENERGY IGNITION SYSTEM FOR STARTING A GAS TURBINE ENGINE
A. S. Shteynberg *In its* Automobile Ind. 6 Jun. 1966 p 17–27 (See N67-11245 02-15) CFSTI: HC $2.00/MF $0.50

To improve starting characteristics of a gas turbine engine it is advisable to use a low voltage ignition system of high energy capacitance type (10 to 12 joules). In the Rotaks ignition system the use of additional throttle inductance increases the time of flow of the discharge current through the spark plug and improves the ignitability of the discharge. Author (TAB)

N67-11270# Aeroprojects, Inc., West Chester, Pa.
ULTRASONIC WELDING PROCESS AND EQUIPMENT FOR CONSTRUCTION OF ELECTRON-TUBE MOUNTS
John G. Thomas Jun. 1966 68 p
(Contract DA-36-039-SC-86741)
(AD-639212) CFSTI: HC $3.00/MF $0.75

The sample lot of 100 type 6080WB electron tubes, fabricated as the end-product of this program, was subjected to heater-cycling, shock, fatigue, 2000-hour life, stability and survival, and electrical acceptance tests. After testing, tubes were examined physically and metallographically to determine cause of failure. Of the 35 failures, 7 rejects were attributable to weld defects. Failures due to inadequacies in this first effort with ultrasonic welding tooling can be minimized or eliminated through further optimization of the special tooling beyond that provided for under the scope of this program. These results demonstrate the potential capability of the ultrasonic welding process in electron-tube manufacture. Author (TAB)

N67-11288*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME MATERIALS PROBLEMS IN SPACECRAFT
Ralph A. Happe *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 55–65 (See N67-11284 02-31) CFSTI: HC $3.00/MF $0.75

Materials problems, unique for spacecraft design and fabrication of minimum weight structures, were compiled according to pressure, temperature, electromagnetic radiation, meteor, neutral gas, ion, and electron environments. A first approximation on the behavior of metals in a temperature-vacuum environment was obtained by using the Langmuir equation to predict the sublimation rate of various elemental metals. Also discussed were conditions that lead to embrittlement, lowered strength, shrinking, electrical and physical changes in polymer materials, and the deterioration of white paints on spacecraft surfaces. G.G.

N67-11327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF EMBEDMENT AND OTHER METALLURGICAL AND MECHANICAL CHARACTERISTICS OF CROSS-WIRE RESISTANCE WELDS
James. H. Munford Washington, NASA, Nov. 1966 27 p refs
(NASA-TN-D-3714) CFSTI: HC $1.00/MF $0.50 CSCL 13H

An investigation was performed to evaluate the cross-wire resistance welded joints used in welded electronic assemblies for aerospace applications. Mechanical strength and reproducibility of strength were determined for several alloy combinations by performing single torsion-shear tests in a pneumatically operated pull testing machine. A metallographic investigation was performed in order to determine the type of bonding and the degree of mutual embedment resulting from the welding operation. Material combinations investigated were Nickel 200 interconnect welded to itself, Kovar, Alloy 180, and Dumet; and Alloy 180 interconnect welded to itself, Kovar, and Dumet. Strength, embedment, and consistency data indicate that an optimum degree of embedment exists for each combination of materials. For the material combinations studied, the optimum embedment was found to be between 10 and 25 percent of the wire diameter. Author

N67-11349*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.
MATERIALS FOR POTASSIUM LUBRICATED JOURNAL BEARINGS Quarterly Progress Report No. 11, Oct. 22, 1965–Jan. 22, 1966
R. G. Frank, ed. 22 Jan. 1966 131 p refs
(Contract NAS3-2534)
(NASA-CR-72028) CFSTI: HC $3.00/MF $0.00 CSCL 13H

Details are given on continuing research performed to evaluate materials suitable for potassium lubricated journal bearing and shaft applications in space system turbogenerators operating over a 400° to 1600°F temperature range. These include (1) evaluation of the compatibility of candidate bearing material combinations in a Nb-1Zr alloy/potassium system, (2) X-ray diffraction analysis of the facing surfaces of the candidate bearing material combinations tested at 1600°F, (3) spectrographic analyses of the potassium drained from the capsules containing the TiC+10% Nb specimens, (4) microhardness surveys of all the corrosion test specimens individually or in combination with Mo-TZM alloy in potassium liquid and vapor, (5) potassium wetting tests, (6) friction and wear tests conducted in high vacuum, (7) rotating tests in both high vacuum and liquid potassium friction wear testers, and (8) high speed water flow tests. L.E.W.

N67-11350*# General Electric Co., Cincinnati, Ohio. Research and Development Center.
HYDRODYNAMIC JOURNAL BEARING PROGRAM Quarterly Progress Report No. 2, Jul. 29–Oct. 29, 1966

J. D. Mc Hugh, H. E. Nichols, W. D. C. Richards, and H. C. Lee
18 Apr. 1966 85 p refs
(Contract NAS3-6479)
(NASA-CR-72033) CFSTI: HC $2.50/MF $0.75 CSCL 13I

A computer program is presented which predicts rotor response and threshold of instability for a symmetrical rotor-bearing configuration and given bearing spring and damping coefficients. The program also calculates the bearing spring and damping coefficient from experimentally obtained fluid film forces and rotor displacements. These coefficients apply to bearings of similar geometry and are independent of the test rotor configuration. The test rig for the experimental part of this program has been designed and is in manufacture. Also, bench testing of the Bently proximity probes for improved accuracy is under way. Author

N67-11678# Franklin Inst., Philadelphia, Pa. Labs. for Research and Development.
MATHEMATICAL ANALYSIS OF THE LAMINATED ELASTOMERIC BEARING Final Report
R. Clyde Herrick May 1966 120 p refs
(Contract DA-44-177-AMC-110(T))
(F-B2140-1; USAAVLABS-TR-66-21; AD-637213) CFSTI: HC $4.00/MF $0.75

The purpose of this study was the establishment of analytical design procedures for laminated elastomeric bearings. This was approached with the application of the linear mathematical theory of elasticity and later with nonlinear large-deformation elasticity theory. The linear theory yielded analytical approximations that are close to exact solutions and which are easily applied and evaluated. This analysis of one typical lamination yields the distribution of stress and deformation in the elastomer between 'rigid' metal lamina. However, the limits of the linear elasticity theory are exceeded for greater than small bearing loads, indicating the need for the application of the more comprehensive large-deformation elasticity theory. The large-deformation theory was stated and the equilibrium equations were derived, but the solution of these equations was not carried out Author (TAB)

N67-11687*# General Electric Co., Cincinnati, Ohio. Flight Propulsion Div.
DEVELOPMENT AND BUILD OF PROTOTYPE TOOLS FOR INDUCTION BRAZING OF STAINLESS STEEL TUBING AND FITTINGS FOR NASA APPLICATIONS Final Report
D. H. Greisl Mar. 1966 106 p
(Contract NAS8-11554)
(NASA-CR-79752; R66FPD47) CFSTI: HC $4.00/MF $0.75 CSCL 13I

Areas described are: the design and manufacture of sizing tools for the tubing to be brazed; the design of couplings, elbows, and tee type fittings; the design and manufacture of split type induction tools to braze these fittings to the tube ends; the design and manufacture of the debrazing tools; and the use of high frequency induction brazing of heavy wall tubing (.188 wall thickness–O.D. 2"). Author

N67-11718# Sandia Corp., Albuquerque, N. Mex.
CLEAN ASSEMBLY PRACTICES GUIDE
D. E. Fjeseth, D. M. Davis, L. K. Jones, and C. F. Schroeder Oct. 1965 56 p refs
(Contract AT(29-1)-789)
(SC-DC-66-1118) CFSTI: HC $3.00/MF $0.75

A practical guide to clean assembly practices relating to manufacturing processes for high reliability precision components is described. Process requirements cannot be stated with the same precision as can dimensions, material characteristics, and their associated tolerances, but the guide does point out recurrent areas of process difficulties related to cleaning and suggests controls to minimize contamination. NSA

N67-11720# Union Carbide Nuclear Co., Oak Ridge, Tenn.
AN INVESTIGATION OF THE MAGNETIC-PULSE FORMING PROCESS
F. W. Jones 10 Jan. 1966 111 p refs
(Contract W-7405-ENG-26)
(Y-1483) CFSTI: HC $4.00/MF $0.75

An investigation of the magnetic-pulse forming process, which is one of the newest methods of forming metals at high strain rates is described. A simple method is presented for measuring strain rates of tubular-shaped parts. The strain rate of the magnetic-pulse forming process has been determined and compared with other high-strain-rate processes such as explosive forming. Tubing has been bulged with the magnetic-pulse forming process from which calculations were made to determine the efficiency of the process. This efficiency has been compared with other high-strain-rate forming processes. The equations necessary for predicting the performance of this new forming process are summarized. Graphs of forming pressure versus stored energy are also presented. The problem of design and manufacture of forming coils is discussed in detail along with examples of coils that have been constructed and the experimental results of these coils. The limitations of this new forming process are presented along with examples of parts that are ideally suited for this manufacture process. Author (NSA)

N67-11795*# Israel Program for Scientific Translations, Ltd., Jerusalem.
TUBE PRODUCTION FROM THE AT-3 TITANIUM ALLOY
V. Ya. Ostrenko, N. V. Bogoyavlenskaya, L. D. Bobrikov, E. P. Akimova, V. K. Usov et al *In its* Titanium and its Alloys 1966 p 271–278 (See N67-11781 02-17) CFSTI: HC $7.00/MF $2.00

The AT-3 titanium alloy is found to be suitable for tube production, even though the consumption coefficient of the metal during tube drawing is quite high because of a tendency of the titanium to stick to the dies. An oxide film obtained in a fused alkaline salt is considered the best coating to counteract sticking to the dies. Data are compared for hot and cold drawing; and tests are detailed on the pierceability, torsion at high temperatures, and rollability in the cold condition. Degree of deformation during a single pass in cold condition could be as high as 55%. In addition to the sticking, the hot rolled tubes had a gas-saturated surface layer; and an impact strength lower than specifications. Better results are shown for the cold-drawn tubes, with an ultimate strength equal to 75 to 90 kg/mm^2 and elongation of between 15 and 20%. M.W.R.

N67-11797*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE INVESTIGATION OF COLD ROLLING OF A TITANIUM ALLOY STRIP
V. I. Shilov, V. P. Korzh, and L. P. Odinokova *In its* Titanium and its Alloys 1966 p 283–296 refs (See N67-11781 02-17) CFSTI: HC $7.00/MF $2.00

Plastic deformation during cold rolling of high strength titanium alloys takes place at specific pressures between 200 and 450 kg/mm^2 and strip tension between 30 and 60 kg/mm^2, which is about 0.3 to 0.5 of the yield strength of the material in question. The alloys display satisfactory plastic properties, which facilitate foil production; and cold rolling of AT-3 and AT-4 alloys produced foils up to 0.07 mm in thickness and 70 to 80 mm in width. Because of the high specific pressure, there is an elastic flattening of the working and back-up rolls during rolling. To increase contact hardness and maximum strip rollability, titanium alloys should be cold rolled. M.W.R.

N67-11803*# Israel Program for Scientific Translations, Ltd., Jerusalem.
SOLDERING AND BRAZING OF AT-3 TITANIUM ALLOYS COATED WITH DIFFERENT ELECTRODEPOSITS
A. Ya. Shinyaev and V. V. Bondarev *In its* Titanium and Its Alloys 1966 p 339–343 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Consideration is given to the soldering of an AT-3 titanium alloy with protective costings of rhenium, rhodium, or silver; and microscopic observations of the soldered joint indicate that the diffusion zone is wider on rhodium costed alloys than on the rhenium or silver. When copper–silver solders are used, plating to a 15 to 25 μ thickness effectively protects the titanium from oxidation and from any reaction with the components of the solder. Tension tests indicate that the strongest joints are obtained for the silver-costed specimen at a temperature between 780 and 790°C, for rhenium at 790 to 800°C, and for rhodium between 800 and 810°C. A solid solution of the electrodeposits in titanium with separate inclusions of second phase nuclei is found in the diffusion zones of maximum strength joints with all three costings.
M.W.R.

N67-11813*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FILM-TRANSFER STUDIES OF SEVEN BALL-BEARING RETAINER MATERIALS IN 60°R (33°K) HYDROGEN GAS AT 0.8 MILLION DN VALUE
David E. Brewe, Herbert W. Scibbe, and William J. Anderson Washington, NASA, Nov. 1966 27 p refs
(NASA-TN-D-3730) CFSTI: HC $1.00/MF $0.50 CSCL 13I

Seven self-lubricating retainer materials (a laminated glass cloth with polytetrafluoroethylene (PTFE) binder, a glass-fiber–molybdenum disulfide-filled PTFE, a glass-fiber-filled PTFE, a bronze-filled PTFE, copper–PTFE–tungsten diselenide composite, a silver–PTFE–tungsten diselenide composite, and a molybdenum disulfide-filled polyimide) were evaluated in 40-millimeter-bore ball bearings operating in hydrogen gas at 60°R (33°K). The bearings were operated at 20,000 rpm with a 200-pound (890 N) thrust load for total times to 10 hours. Individual bearing runs were of approximately 2-hour durations. The formation and subsequent life histories of the transfer films were studied and evaluated from highly magnified profile traces of the bearing inner-race grooves. The wear and mechanical integrity of the retainer materials were determined by visual observations and weight-differential measurements after each 2-hour run.
Author

N67-11824*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FABRICATION OF A BERYLLIUM TEST PANEL
G. H. Jones and C. M. Wood 29 Oct. 1966 37 p ref
(NASA-TM-X-53529) CFSTI: HC $2.00/MF $0.50 CSCL 13H

The fabrication of a beryllium test panel made in support of projected programs which will use beryllium for major structural applications is described. Manufacturing techniques involved were machining, forming, etching, and assembly. By using proper tooling and by exercising close controls over each operation, the panel was fabricated to the required configuration and tolerances.
Author

N67-11831# Joint Publications Research Service, Washington, D. C.
MANUFACTURE OF THIN PLATES FROM REFRACTORY CARBIDES
B. G. Ignatyev, L. B. Nazhevenko, A. V. Kovalev, N. I. Poltoratskiy, G. S. Fomin et al 28 Nov. 1966 11 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 20, no. 6, Jun. 1966 p 489–494
(JPRS-38834; TT-66-35258) CFSTI: $1.00

The manufacturing of high density, thin zirconium carbide plates by pressing and by rolling carbide powder, with subsequent baking, is described. The baking was done in a vacuum furnace at 2400°–2500°C. Details are given on the two methods, the chemical composition of the carbides, and on the effectiveness of additives in increasing the density. It was determined that the density of the thin plates was 6.3 gm/cm^3 for pressed plates and 6.5 gm/cm^3 for the rolled plates, and the rolling procedure is considered superior.
N.E.N.

N67-11833# Forest Products Lab., Madison, Wis.
REACTIONS OF UNBALANCED PANEL CONSTRUCTION TO SLOW AND RAPID CHANGES IN RELATIVE HUMIDITY
B. G. Heebink Jan. 1966 10 p ref
(FPL-0116)

Wood panel materials consisting of a decorative laminate, core, and backing were subjected to different relative humidity changes to determine the effect on warping. Details are presented on the materials, assembly, and preconditioning. Half the specimens had sudden changes in the relative humidity and the other half had gradual changes. It was found that the final degree of warp was about the same for both groups. It was also determined that the unbalanced construction warps first in one direction followed by a reverse warp in the opposite direction when equilibrium moisture content condition is reached.
N.E.N.

N67-11839# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
ELECTROLYTIC METHODS FOR PRODUCING TITANIUM AND TITANIUM ALLOYS
E. K. Kleespies and T. A. Henrie 1966 14 p refs
(BM-RI-6875)

A technique for electrowinning titanium from titanium nitride and titanium dioxide is described. Titanium–nickel–copper metal solutions containing 26 to 61 weight-percent titanium were prepared by electrolyzing titanium nitride in molten mixtures of potassium fluotitanate, and sodium chloride or barium chloride and depositing titanium on nickel–copper cathodes. A titanium–nickel alloy was prepared by electrolyzing titanium dioxide in an electrolyte of potassium fluotitanate, sodium fluoride, and calcium fluoride and depositing titanium on solid nickel cathodes. This alloy contained 21 weight-percent titanium and had a combined oxygen-carbon content of less than 0.1 weight-percent. A compartmented cell confined the oxide feed near the anode and inhibited oxygen contamination of the metal.
Author

N67-11942*# Franklin Inst., Philadelphia, Pa. Research Labs.
DYNAMIC STABILITY OF ROTOR-BEARING SYSTEMS
Edgar J. Gunter, Jr. (Va. Univ.) Washington, NASA, 1966 234 p refs
(Contract NAS3-6473)
(NASA-SP-113) GPO: HC $1.00; CFSTI: MF $1.25 CSCL 13I

Discussed are general conditions which can lead to nonsynchronous precession in a rotor system; considered were shaft whirling, oil film whirl, resonance whip, and half-frequency whirl. In the analysis, general equations of motion are developed to include rotor and foundation flexibility, internal and external damping, rotor and bearing mass, and fluid film bearings. The rotor threshold of stability is determined and from the various stability charts developed it was concluded that improved rotor stability characteristics can be obtained by a proper foundation design.
G.G.

N67-11946*# National Aeronautics and Space Administration, Washington, D. C.
LUBRICATION, CORROSION AND WEAR—A CONTINUING BIBLIOGRAPHY WITH INDEXES, APRIL 1965–AUGUST 1966
Oct. 1966 302 p refs
(NASA-SP-7020(01)) CFSTI: HC $3.75/MF $1.50 CSCL 13H

This supplement to the original issue of the continuing bibliography on "Lubrication, Corrosion and Wear" presents a selection of annotated references to unclassified reports and journal articles that have been announced in Scientific and Technical Aerospace Reports, or in International Aerospace Abstracts. References reflect the design and development of equipment and materials for use in a space environment and cover such topics as lubricating systems; design and performance of bearings; special applications of lubricants; stress corrosion and fatigue cracking in metals and alloys; friction and wear characteristics of materials, and types of corrosion and techniques of corrosion prevention. A subject index and a personal author index are included. G.G.

N67-11963*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SATURN V, S-IC Y-RING ELECTRON BEAM WELDING SYSTEM

R. V. Hoppes, W. P. Stanton, and M. W. Brennecke 30 Mar. 1965 89 p refs

(NASA-TM-X-57109; R-ME-IN-65-4) CFSTI: HC $3.00/MF $0.75 CSCL 13H

This report presents the development and verification of an electron beam (EB) system for joining S-IC Y-ring segments. The report is divided into vacuum chambers, electronic systems, tooling, and weld evaluation. The data obtained in the verification period shows that the EB system is an improved and successful method of Y-ring joining. It is recommended that the system be used in the manufacturing of Saturn V, S-IC stage Y-ring. Author

N67-11997# Metaalinstituut TNO, Delft (Netherlands). Afdeling Corrosie.

INVESTIGATION OF THE CORROSION-PREVENTIVE CHARACTERISTICS OF TEMPORARY PRESERVING AGENTS [ONDERZOEK NAAR THE CORROSIEWERENDE GEDRAG VAN TIJDELIJKE PRESERVEERMIDDELEN]

3 Aug. 1966 23 p refs In DUTCH

(TDCK-46171; Rept.-1) 6-66-669) CFSTI: HC $1.00/MF $0.50

The tests were specifically conducted to evaluate the suitability of these corrosion-preventive agents for military use. Seven standard agents now in military use and samples of three new products that were submitted by the manufacturers were evaluated. The agents were of the following types: thin oils with inhibitors or thinners; vaselines; stiff plastic substances; volatile detergent oils; bitumen solutions; and polyvinyl butyral compounds. The samples were tested on steel plates for atmospheric exposure, salt spray, humidity with SO_2 contents, and intermittent submersion in NaCl solution. Effective lengths of protection and quality ratings of the agents are shown in tables. Also presented is a brief report on the preparation and evaluation of waterproofing varnishes. Transl. by K.W.

N67-11999# Rubber Research Inst. TNO, Delft (Netherlands).

SWELLING TESTS WITH CABLE INSULATING MATERIALS IN FOUR TYPES OF OIL [ZWELPROEVEN MIT MANTELS VAN EEN AANTAL KABELS IN 4 OLIESOORTEN]

J. J. Kruys, G. J. Flim, and E. A. Walraad 14 Jun. 1966 5 p refs In DUTCH

(TDCK-45714; MAR-6616) CFSTI: HC $1.00/MF $0.50

The swelling of eight electric cable insulation samples was measured after submersion at 50°C in four different types of oil for periods of 1 week, 4 weeks, and 8 weeks. The oil was provided by the Dutch Navy and included one diesel oil, two lubrication oils, and one hydraulic oil. The test results are presented in tables. Transl. by K.W.

N67-12070*# Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION, TESTING, AND SELECTION OF SLIP-RING LEAD WIRES FOR USE IN HIGH-PRECISION SLIP-RING CAPSULES Final Report

R. H. Ernst, D. N. Williams, and E. S. Bartlett 15 Sep. 1966 115 p refs

(Contract NAS8-20188)

(NASA-CR-80081) CFSTI: HC $4.00/MF $0.75 CSCL 13H

Since galvanic corrosion was a serious problem in the silver-plated copper wires used in slip-ring assemblies of the Saturn guidance and control systems, thirty silver alloys were evaluated in compliance with lead-wire requirements. The best three alloys (Ag–1.5 Cu, Ag–0.2 Ni, and Ag–1 Cu–0.2 Ni) were scaled up to 19-strand, 42-gage, Teflon-insulated lead wires for complete evaluation. It was found that the silver alloys had excellent corrosion resistance; they were very fabricable; they were resistant to reactions with Teflon during curing of the insulation; their properties were not affected by exposure to air during the Teflon-curing cycle; and they met the ultimate strength and electrical conductivity requirements. Details are given on selection of candidate alloys, experimental procedures, results of studies of laboratory-processed wire, results of the alloy scale-up program, and evaluation of slip-ring lead wires. Surveys of commercial silver alloys and of alloying effects are also included. L.E.W.

N67-12095*# General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section.

HYDRODYNAMIC JOURNAL BEARING PROGRAM Quarterly Progress Report, Jan. 29–Apr. 29, 1966

J. C. Amos, W. H. Bennethum, H. E. Nichols, W. D. C. Richards, and R. J. Rossbach 29 Apr. 1966 94 p refs

(Contract NAS3-6479)

(NASA-CR-72068; QPR-4) CFSTI: HC $2.50/MF $0.75 CSCL 13I

Design and fabrication of a self-aligning pivoted-pad bearing with two values of preloading is discussed, and fabrication of a three-lobed bearing and a backup test shaft is described. The use of optical tooling for the determination of the specific conditions of both angular and transverse misalignment of the test bearings is explained. Feasibility and calibration tests of force and displacement measurements were conducted. A digital data system for recording the dynamic bearing characteristics was prepared. An analysis of the preloaded pivoted pad bearing was made to guide test planning. Rotor bearing response data over ranges of speed, side load, and unbalance are presented. K.W.

N67-12231*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MANUFACTURING ENGINEERING LABORATORY'S WELD ENVIRONMENTAL CONTROL

Daniel M. Daley Jan. 1964 11 p Presented to the 1st S-IV, S-IV-B MEWGM, 15–16 Jan. 1964

(NASA-TM-X-59978) CFSTI: HC $1.00/MF $0.50 CSCL 13H

The development of environmental controlled areas for the fabrication of the S–IC vehicle is reported. The purpose of these areas is to insure that all of the welds made in space vehicle structures will be of a high and reproducible quality. A semiportable atmospheric control system for the fabrication of both meridian and Y-ring-to-bulkhead welds, and a portable atmospheric control system which is used to establish environmental control around the dollar weld in the S–IC bulkheads; are described. These two systems focus on controlling dirt and dust levels, draft or wind, moisture, and temperature. Also described is an experimental area that is being installed in Marshall's experimental welding laboratory, which will be used to develop the optimum conditions for welding the Y-ring-to-bulkhead. It is anticipated that results of these studies will set the pace for space vehicle fabrication needs in the control of atmospheric conditions and still obtain the extreme high quality needed to attain the reproducible maximum quality that will result in successful space flight vehicle systems. S.C.W.

N67-12279*# National Aeronautics and Space Administration, Washington, D. C.
BRAZING AND BRAZING ALLOYS–A BIBLIOGRAPHY
1966 59 p refs
(NASA-SP-5026) CFSTI: HC $3.00/MF $0.50 CSCL 13H

The material presented was selected from a retrospective search of NASA's Scientific and Technical Information Division's data bank, and was carefully reviewed to include only those items which have specific industrial application. It includes alloys, basic and technical papers, fabrication and development methods, and testing and evaluation. The emphasis throughout is on application of new technology. A list of several significant representative entries, and an index according to applications are included. N.E.N.

N67-12280* Solar, San Diego, Calif.
LIQUID HYDROGEN FLEXIBLE DUCTING TECHNOLOGY Final Report, Jun. 1964–Jan. 1966
H. T. Mischel 30 Jun. 1966 147 p
(Contract NAS8-11303)
(NASA-CR-79730; ER-1473-15) CFSTI: HC $4.00/MF $1.00 CSCL 13K

A description is presented for work performed in attempting to improve the state-of-the-art in the technology of liquid hydrogen flexible ducting for space flight vehicle applications. The various components which make up a typical LH_2 flexible ducting system were segregated and individually studied for areas of possible improvement. Areas where information was lacking were designated for further analytical and empirical studies. A boltless flange concept was developed and subjected to limited testing. Tubing was studied from a material substitution standpoint; and a flexible elbow concept was developed but not tested. Flexible joints were studied at length and a low-profile gimbal joint was fabricated and tested. Various materials and material combinations were tested to obtain data for designing spherical ball joints which could operate in a vacuum. An improved analytical method for predicting critical squirm pressure of bellows was verified in an extensive testing program. A non-rigid vacuum insulation was conceptualized but not tested. Author

N67-12283# Naval Ordnance Test Station, China Lake, Calif.
ULTRASONIC TREATMENT OF SPECIMENS IN THE ELECTRON MICROSCOPE
B. Langenecker Apr. 1966 8 p refs
(NAVWEPS-9059; NOTS-TP-4075; AD-631228)

A method and technical details are described for direct observation of effects of high amplitude ultrasonic stress waves on dislocations in metal crystals. The technique combines, for the first time, ultrasonic treatment at high acoustic energy densities (up to 10^9 ergs/cu cm at frequencies between 30 and 100 kc), observation of damping of stress waves, and electron microscopy. Results from this in situ technique allow fundamental refinement of present theories on ultrasonic activation of dislocation mechanisms. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N67-11313# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF EXPERIMENTAL AND THEORETICAL PHYSICS
1 Apr. 1966 10 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow) v. 1, no. 4, 15 May 1965 p 4–9, 21–24
(FTD-MT-65-399; TT-66-62091; AD-637413) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. AMPLIFICATION OF COHERENT RADIATION, USING THE EFFECT OF INDUCED RAMAN SCATTERING B. A. Akanayev, S. A. Akhmanov, and R. V. Khokhlov p 1–5 refs (See N67-11314 02-16)

2. SPECTRAL CHARACTERISTICS OF A GAS LASER WITH A TRAVELING WAVE S. N. Bagayev, V. S. Kuznetsov, Yu. V. Troitskiy, and B. I. Troshin p 7–10 ref (See N67-11315 02-16)

N67-11314# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AMPLIFICATION OF COHERENT RADIATION, USING THE EFFECT OF INDUCED RAMAN SCATTERING
B. A. Akanayev, S. A. Akhmanov, and R. V. Khokhlov *In its* J. of Exptl. and Theoret. Phys. 1 Apr. 1966 p 1–5 refs (See N67-11313 02-16) CFSTI: HC $1.00/MF $0.50

A combination Raman generator is described which is based on the phenomenon of induced Raman scattering for the generation and amplification of the Stokes wave. Excitation of the proposed generator is accomplished using a ruby laser with Q-modulation. The beam of light from the ruby laser source is divided into two beams one of which passes along the benzenes irradiated by pumping, the other along an air filled vessel. Amplification is determined by compering the ratio of the intensities of Stokes and Reyleigh components of each beam. Registration of amplification is produced on photographic plates. Preliminary experiments showed that by using the phenomenon of induced Raman scattering it is possible to construct a receiver of coherent radiation. S.C.W.

N67-11315# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTRAL CHARACTERISTICS OF A GAS LASER WITH A TRAVELING WAVE
S. N. Bagayev, V. S. Kuznetsov, Yu. V. Troitskiy, and B. I. Troshin *In its* J. of Exptl. and Theoret. Phys. 1 Apr. 1966 p 7–10 ref (See N67-11313 02-16) CFSTI: HC $1.00/MF $0.50

The effects of decoupling of longitudinal modes on multimodality of a gas laser in a resonator with a traveling wave propagating in one direction were studied. A gas laser on the wavelength $\lambda = 6328$Å with an annular resonator was prepared in which clockwise (A) and counter-clockwise (B) traveling waves were generated. The resonator was formed by three mirrors, two of which had a transmission of 0.2% and 3.4%, respectively. The discharge tube was filled with a mixture of neon and helium in a ratio of 1:5 with a total pressure of 0.5 mm Hg. To produce a traveling wave with one direction, an additional mirror was used which reflected part of the energy of wave B to A. As a result, during generation the intensity of wave A was five to seven times greater than that of wave B. Interferograms showed that the number of modes in this system oscillated from one to two. Results indicated that the generated modes did not travel over the entire spectral lines but were connected with a certain section of them, and that the power of generation did not change with time. It is concluded that elimination of spatial heterogeneity of the field in a laser resonator permits strengthening of the bond between types of oscillation (even in case of non-uniformly widened lines) and makes it possible to obtain adequate power generation with one to two longitudinal modes. S.C.W.

N67-11380*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
AN INTERFEROMETRIC RANGING SYSTEM

Diane Marie Tillson Sep. 1966 75 p refs
(NASA-TM-X-55608; X-524-66-408) CFSTI: HC $2.50/MF $0.75 CSCL 20E

The need for an accurate linear measuring system in the range of one hundred meters has resulted in the investigation of potential laser applicability. An interferometric type ranging system which utilizes a continuous-wave laser is analyzed. Theoretical analysis shows that one can utilize the difference frequency between adjacent TEM longitudinal modes of a cw laser to make accurate distance measurements. Equations are developed to establish mathematically the relation between phase information, which results from the photo-mixing of two monochromatic light beams, and the path lengths of these two signals. The validity of this idea is verified experimentally. Measurements which were accurate to a half millimeter were obtained using this ranging system. The accuracy of the system is limited by the system's noise level and by the laser stability. Author

N67-11738*# Case Inst. of Tech., Cleveland, Ohio.
DEVELOPMENT OF LASERS FOR PLASMA DIAGNOSTICS
W. B. Johnson and T. P. Sosnowski Jul. 1964 114 p refs
(Grant NsG-198)
(NASA-CR-79511; A-29) CFSTI: HC $4.00/MF $0.75 CSCL 20E

Discussed is the construction of an optical heterodyne system for measuring the electron density of a plasma. Initially the scheme is established theoretically, followed by a detailed account of the construction of the helium-neon gaseous lasers. Design parameters are established to determine the most efficient means of operation. It is found that the laser can operate at gas pressures and input currents from 1.6 mm to greater than 10 mm Hg pressure and 5 ma to greater than 60 ma respectively, with optimum operation occurring at 3.8 mm Hg pressure at a current of 30 ma. The heterodyning of two laser beams is then considered; the stability of the resultant beat frequency is found to be seriously impaired by such environmental factors as building vibration and very small temperature fluctuations. The minimum frequency drift encountered in the experiment was approximately 50 kc/s in a 1 sec period and is comparable to the frequency shift obtained with an electron density of 10^{12} electrons/cc. Recommendations are then made which should either mitigate or eliminate the causes of frequency drift. Author

N67-11969# Joint Publications Research Service, Washington, D. C.
FEATURES OF CZECHOSLOVAK-PRODUCED GAS LASERS
Frantisek Petru 27 Sep. 1966 12 p Transl. into ENGLISH from Sdelovaci Technika (Prague), v. 1966, no. 6, Jun. 1966 p 208–209
(GUO-2177) CFSTI: $1.00

Technical aspects of gas lasers, including basic resonator setup, beam radius and polarization, and resonator adjustment, are presented. The use of these gas lasers is advised in cases where the emphasis is on monochromaticity and coherence, directionality, high intensity, perfect polarization, and continuous operation of discharge radiation. S.P.

N67-12260*# Ohio State Univ. Research Foundation, Columbus. Dept. of Electrical Engineering.
A PRELIMINARY INVESTIGATION OF LASER ACTION ASSISTED BY OXIDIZED HYDROCARBONS
Benjamin Franklin Jacoby 7 Oct. 1966 12 p *Its* Rept.-1093-32
(Grant NsG-74-60)
(NASA-CR-80090) CFSTI: HC $1.00/MF $0.50 CSCL 20E

This report describes the apparatus constructed to investigate the possibility of new laser line in the infrared and far infrared regions and some preliminary results are presented of a study where CO_2 and CO were generated by a chemical reaction within the discharge tube and made to lase. Author

N67-12294# Pacific Missile Range, Point Mugu, Calif.
DESCRIPTION AND APPLICATION OF LASER RADAR AT PACIFIC MISSILE RANGE
J. L. Karney, J. E. Masterson, and W. E. Hoehne 17 Aug. 1966 22 p ref
(PMR-TM-66-6; AD-638754) CFSTI: HC $1.00/MF $0.50

The prototype device, called the Mark III Lidar (light detection and ranging) is presently undergoing operational evaluation. A preliminary description of the data and results obtained are given. The lidar is a new and unique tool which promises to provide meteorologists and atmospheric physicists a means to accomplish tasks not possible using present equipment. The Lidar may someday assist the meteorologist in making short-range forecasts by providing slant-range visibility data and quantitative measurements of stratus density and fog thickness. The Lidar is capable of determining precise ranges to clouds (together with their bases and tops), measuring the height of temperature inversions, and detecting atmospheric phenomena in 'apparently clear atmospheres. At the present time, the Lidar data are used in conjunction with observations from other sources to supplement and improve existing weather information. With relatively minor modifications, the Lidar could significantly augment the present methods of gathering atmospheric data. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N67-11244# Royal Aeronautical Society, London (England). Engineering Sciences Data Unit.
MATERIAL PROPERTIES HANDBOOK. VOLUME IV: HEAT RESISTING ALLOYS
Noel H. Mason May 1966 260 p CFSTI: HC $3.75/MF $1.25

Tabulated data on iron, nickel, and cobalt based heat resisting alloys which were developed in NATO nations for structural use at elevated temperatures in aircraft, missiles, spacecraft, and power plants are presented. Data are divided into National Sections, each section dealing with the alloys produced by one country. In each National Section there is, for each distinct alloy or group of alloys, a set of sheets which give data on chemical composition, and physical and mechanical properties both at room and elevated temperatures. Preceding these sheets are Introductory Notes which give general information and amplify such points as the designations and specification of the alloys, heat treatment, and testing procedures. The following nations are represented: Belgium, Canada, France, Germany, Italy, Netherlands, Norway, United Kingdom, and the United States. S.C.W.

N67-11251# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF STEELS AND ALLOYS Selected Articles
1 Apr. 1966 19 p refs Transl. into English from Akad. Nauk SSSR. Issled. Staley i Splavov (Moscow), 1965 p 121–124, 147–149
(FTD-MT-65-412; TT-66-62074; AD-637378) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. PARAMETERS OF RECRYSTALLIZATION OF NIOBIUM AND TUNGSTEN L. N. Larikov, Ye. E. Zasimchuk, and M. N. Semenenko p 1–7 refs (See N67-11252 02-17)

2. INFLUENCE OF TITANIUM AND MOLYBDENUM ON THE TEMPERATURE OF RECRYSTALLIZATION AND HARDENING OF NIOBIUM ALLOYS I. Ya. Kontorovich, L. Ya. Savkina, and G. V. Estulin p 9–13 refs (See N67-11253 02-17)

N67-11252# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PARAMETERS OF RECRYSTALLIZATION OF NIOBIUM AND TUNGSTEN

L. N. Larikov, Ye. E. Zasimchuk and M. N. Semenenko *In its* Invest. of Steels and Alloys 1 Apr. 1966 p 1–7 refs (See N67-11251 02-17) CFSTI: HC $1.00/MF $0.50

The temperature dependences of the linear growth rate of recrystallization centers of niobium and tungsten were investigated. A comparison of temperature coefficients of recrystallization center growth rates of both metals with self-diffusion parameters showed that in both cases the magnitude of Q_G was greater than the activation energy of volume self-diffusion. The connection of recovery and recrystallization processes with softening of niobium and tungsten was studied. The recovery kinetics of tungsten were studied in terms of the narrowing rate of X-ray interference lines at three annealing temperatures. Tungsten lines narrowed intensively even at a temperature of 870°C, but hardness measurements showed that the line narrowing is not accompanied by a softening of tungsten. A comparison of data on the growth rate of niobium recrystallization centers with previous results in which niobium softening was investigated, shows that decrease in niobium hardness, plastically deformed at room temperature, occurs during annealing before recrystallization. R.N.A.

N67-11253# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF TITANIUM AND MOLYBDENUM ON THE TEMPERATURE OF RECRYSTALLIZATION AND HARDENING OF NIOBIUM ALLOYS

I. Ye. Kontorovich, L. Ya. Savkina, and G. V. Estulin *In its* Invest. of Steels and Alloys 1 Apr. 1966 p 9–13 refs (See N67-11251 02-17) CFSTI: HC $1.00/MF $0.50

The investigation shows that the alloying of niobium with titanium in quantities of 2 to 10% lowers the recrystallization temperature of the alloys and causes no hardening. The alloying of niobium with molybdenum in quantities from 2 to 10% increases the recrystallization temperature and hardens the alloys in the cold and heated state. R.N.A.

N67-11330*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPACE-POWER-SYSTEM MATERIAL COMPATIBILITY TESTS OF SELECTED REFRACTORY METAL ALLOYS WITH BOILING POTASSIUM

L. Rosenblum, C. M. Scheuermann, and T. A. Moss Washington, NASA, 1966 18 p refs Presented at the Symp. on Alkali Metal Coolants–Corrosion Studies and System Operating Experience, Vienna, 28 Nov.–2 Dec. 1966 Sponsored by Intern. Atomic Energy Agency

(NASA-TM-X-52242) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The compatibility of potential niobium and tantalum tubing alloys with boiling potassium was investigated in the range of temperature representative of the upper operational temperatures of a turboelectric space power system. Two types of compatibility test were employed: (1) reflux capsule tests for materials screening, and (2) a forced convection two-phase loop test in which power-system flow rate and temperature gradient service conditions were simulated. Author

N67-11737*# Solar, San Diego, Calif.

STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS

W. D. Brentnall, Mark J. Klein, and A. G. Metcalfe Oct. 1966 24 p refs

(Contract NAS7-469)

(NASA-CR-79546; RDR-1534-1) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The changes in mechanical properties and structure that occur in dispersion strengthened columbium-base alloys induced by loss of interstitials to more reactive metal coatings are discussed. The materials necessary for this investigation (Cb752 and D43) have been procured, analyzed chemically, and studied metallographically. A high-temperature vacuum creep facility is being constructed. Author

N67-11751# United Kingdom Atomic Engergy Authority, Springfields (England). Reactor Fuel Element Lab.

THE MECHANISM OF FAILURE IN UO_2/STAINLESS STEEL CERMETS

J. H. Gittus 1966 10 p refs Repr. of TRG-Memo-1249(S)

(TRG-1278(S); TRG-Memo-1249(S)) CFSTI: HC $1.00/MF $0.50

A model is proposed which explains the irradiation-induced failure of UO_2/stainless steel cermets in terms of the growth of fission-gas bubbles in the damage halos surrounding the fission particles. Failure occurs as a result of the linkage of fission product gas bubbles throughout a substantial proportion of the cermet. The extent of the linkage depends on the total volume occupied by fission product gases in the damaged zones. The failure criterion, which successfully discriminates between failures and non-failures, is delineated. S.P.

N67-11761*# Israel Program for Scientific Translations, Ltd., Jerusalem.

TITANIUM AND ITS ALLOYS. PUBLICATION NO. 10: INVESTIGATION OF TITANIUM ALLOYS

I. I. Kornilov, ed. 1966 444 p refs Transl. into ENGLISH of the publ. "Titan i Ego Splavy. Issledovaniya Titanovykh Splavov" Moscow, Izd. AN SSSR, 1963 Papers presented at the 2d Conf. on the Theoret. and Exptl. Invest. of Titanium Alloys, Moscow, Mar. 1962 Published for NASA and NSF

(NASA-TT-F-362; TT-65-50139) CFSTI: HC $7.00/MF $2.00 CSCL 11F

Conference papers on the reaction of titanium with other metals, and with gases, the structure of titanium alloys, and their corrosion, mechanical, and technological properties are presented. For individual titles see N67-11762–N67-11808.

N67-11762*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CHEMICAL INVESTIGATION OF TITANIUM

I. I. Kornilov *In its* Titanium and Its Alloys 1966 p 1–10 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The physicochemical properties of titanium alloys were determined and the main types of equilibrium diagrams of binary and ternary titanium systems were drawn on the basis of the chemical reactions of titanium with other elements. Included is a review of the principles according to which the maximum concentrations of alpha and beta solid solutions of titanium are determined. Consideration is given to the dependence of the peritectic, peritectoid, eutectic, and eutectoid reactions of titanium systems on the electron structure of atoms and on the position of the reacting elements in the periodic system of elements. R.N.A.

N67-11763*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE PHASE EQUILIBRIUM OF THE Ti-Al-Mo SYSTEM IN THE TITANIUM-RICH ALLOY FIELD

Dzhi-Min Ge and E. N. Pylaeva *In its* Titanium and its Alloys 1966 p 11–18 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The methods of microstructural and X-ray analysis were used to determine the phase equilibrium of the titanium–aluminum–molybdenum system for the part of the phase diagram representing titanium rich compositions. The hardness of the alloys was also measured. The investigations showed that the titanium corner of the ternary Ti–Al–Mo system has a small field representing a limited alpha-solid solution on the basis of alpha-Ti. The maximum solubility of molybdenum in the tenary alpha-solid solution at 600°C is 0.8 to 1.0%. The field of the alpha-solid solution narrows with the increase in temperature from 800° to 1100°C. Alloys of the three phase (alpha + beta + gamma) and of the two phase (beta + gamma) fields have the highest hardness. The hardness of the gamma-solid solution on the basis of TiAl compounds is relatively low. The ternary alpha-solid solution has a variable hardness with a minimum at about 15% of Al. R.N.A.

N67-11764*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE PHASE TRANSFORMATIONS IN THE Ti-Al-Mo SYSTEM

Dzhi-Min Ge and E. N. Pylaeva *In its* Titanium and Its Alloys 1966 p 19–23 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

A thermal analysis of alloys of the Ti-Al-Mo system with aluminum and molybdenum contents of up to 50% was conducted. The thermal analysis included a recording of both heating and cooling curves. Typical thermograms of pure titanium, a binary titanium alloy with 20% Al, and a ternary alloy with 15% Al and 0.5% Mo are shown. The thermal effect of the polymorphic alpha⇄beta transformation of alloys is more marked during cooling than during heating. The transformation temperatures of the alloys were determined according to the thermal effects taking place during heating, and were checked during cooling. The measured temperatures corresponding to the beginning of melting of the alloys together with the temperatures of their polymorphic alpha⇄beta transformations in the solid state are tabulated. The solidus isotherms of alloys of the titanium corner of the Ti-Al-Mo diagrams were recorded according to these data. Consideration is also given to the polythermal sections parallel to the Ti-Mo and Ti-Al sides with constant contents of aluminum and molybdenum, respectively. R.N.A.

N67-11765*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PHASE DIAGRAM OF THE Ti-V-Nb-Mo SYSTEM

O. K. Belousov, I. I. Kornilov, and V. S. Mikheev *In its* Titanium and its Alloys 1966 p 24–33 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

On the basis of a microstructural analysis and measurements of hardness and electrical resistance, phase diagrams were constructed corresponding to a quarternary Ti-V-Nb-Mo system at 800°, 700°, and 600°C for alloys with a total content of alloying elements equal to 50%. The solubility ΣV, Nb, Mo in α- and β-titanium at 600°C is: 1.9 to 2.0%, 1.0 to 1.2%, 2.8 to 2.9%, and 1.9 to 2.0% α-Ti for sections I, II, III, and IV; and 31 to 32%, 26 to 27%, 39 to 40%, and 29 to 30% β-Ti for sections I, II, III, and IV. Alloys hardened from the β field have clearly expressed maxima of hardness and electrical resistance which reflect the presence of metastable phases. The field of the $\beta+\omega$ phases in the quarternary system. R.N.A.

N67-11766*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF ALLOYS OF THE TERNARY Ti-Nb-Cr SYSTEM

K. I. Shakhova and P. B. Budberg *In its* Titanium and its Alloys 1966 p 34–39 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Isothermal sections were constructed of part of the Ti-Nb-Cr phase diagram using the data obtained in microstructural and X-ray phase analysis. In the isothermal section for 1000°C, most of the diagram is taken up by the two-phase field of alloys consisting of a mixture of β- and γ-solid solutions. The solid solution of the $(TiNb)Cr_2$ intermetallic compound is designated by the letter γ. The region of the β-solid solution gradually narrows as the content of niobium in the alloys increases. In the isothermal section for 800°C, the distribution of the phase fields is essentially the same as in the isothermal section for 1000°C except for the appearance of a narrow two-phase $\alpha+\beta$ field in the titanium corner. In the isothermal section for 600°C, a three-phase field $\alpha+\beta+\gamma$ is formed as a result of the eutectoid reaction $\beta \rightarrow \alpha+TiCr_2$ which takes place in alloys of the binary Ti-Cr system. This three-phase field is adjacent to three two-phase fields $\alpha+\beta$, $\alpha+\gamma$, and $\beta+\gamma$. At this temperature the single phase β alloys can exist only if the content of niobium exceeds 50%. R.N.A.

N67-11767*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE PARTIAL PHASE DIAGRAM OF THE Ti-Al-Cr-Fe-Si-B SYSTEM (SECTION WITH 3% OF Al)

V. S. Mikheev, K. P. Markovich, and L. F. Tabadze *In its* Titanium and its Alloys 1966 p 40–46 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

A polythermal section was constructed of the six component Ti-Al-Cr-Fe-Si-B system with a constant content of 3% Al and total contents of chromium, iron, and silicon varying from 0.45 to 2.5%. The phase fields identified were β, $\alpha+\beta$, α, α+residual phase, and $\alpha+\beta+\gamma$. The melting point of alloys of the six component Ti-Al-Cr-Fe-Si-B system, with a constant content of 3% Al, decreases from 1535° to 1400°C as the total content of chromium, iron, and silicon increases from 0.45 to 2.5%. The total solubility of chromium, iron, and silicon in the α-solid solution of titanium was determined to be 1.0% at 600°C and 1.5% at 800°C. R.N.A.

N67-11768*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE PARTIAL PHASE DIAGRAM OF THE Ti-Al-Cr-Fe-Si-B SYSTEM OF ALLOYS CONTAINING 6% OF Al

V. S. Mikheev, T. S. Chernova, and N. M. Dzhibuti *In its* Titanium and its Alloys 1966 p 47–55 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

On the basis of differential thermal analysis and of investigations of microstructure, hardness, and electrical resistance, a polythermal section was constructed of the six component Ti-Al-Cr-Fe-Si-B system with a constant 6% Al content and total contents of chromium, iron, and silicon varying from 0 to 2.5%. The total solubility of chromium, iron, and silicon in the α-solid solution of titanium is 1.3% at 600°C and 1.7% at 800°C. The temperature of the $\alpha \rightarrow \beta$ transformation in the Ti-Al-Cr-Fe-Si-B system is not greatly influenced by the total content of alloying elements. The polythermal section of the six component system indicates the optimum compositions of alloys based on the α-solid solutions, which possess high heat resistance and other desirable physiochemical properties. R.N.A.

N67-11769*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CLASSIFICATION OF TITANIUM ALLOYS ACCORDING TO THEIR STRUCTURE

V. A. Livanov and B. A. Kolachev *In its* Titanium and Its Alloys 1966 p 56–64 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

A proposal is presented for classifying titanium alloys according to their structure in the normalized and hardened conditions with

all alloys divided into α-, $\alpha+\beta$-, and β-phase classes. The division of titanium alloys into groups according to their microstructure in the normalized and hardened conditions can be represented by structural diagrams which are analogous to those used for classifying steels according to their microstructure and annealed condition. R.N.A.

N67-11770*# Israel Program for Scientific Translations, Ltd., Jerusalem.

SOME RESULTS OF THE METALLOGRAPHIC AND X-RAY INVESTIGATIONS OF AT TITANIUM ALLOYS

N. M. Pul'tsin and V. B. Pokrovskaya *In its* Titanium and Its Alloys 1966 p 65–72 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Microstructural, X-ray, and hardness studies were conducted on AT-3, AT-4, AT-6, AT-8, AT-9, and AT-10 alloys, after different treatments. The metallographic analysis showed that all alloys, regardless of type, content of alloying elements, and nature of heat treatment, contain an α-solid solution with either a woven or an acicular structure. The structure is determined by the content of alloying elements, the heating temperature, and the cooling rate during the heat treatment. X-ray analyses confirmed the results of the metallographic analysis and showed that the alloys also contain very small amounts of the β phase. A hardness test revealed that properties of the α-solid solution are not identical in all the alloys. This may be due to the difference degrees of grain refinement of the α-solid solution and to the distortion of the crystal lattice. It could not be determined if the lattice parameters of the α-solid solution change as a result of alloying and heat treatment. R.N.A.

N67-11771*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CRYSTAL STRUCTURE OF SOME TERNARY INTERMETALLIC TITANIUM COMPOUNDS

E. I. Gladyshevskii, V. Ya. Markiv, Yu. B. Kuz'ma, and E. E. Cherkashin *In its* Titanium and Its Alloys 1966 p 73–75 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

A number of systems A–B–C, where A = Mg, Sc, Ti, V, Cr, Mn, Zr, Nb, Hf, Ta; B = Cu, Fe, Co, Ni; and C = Al, Si, Ga, Ge, In, Sn, Sb, Bi, contain ternary intermetallic compounds. Results are presented of an investigation of ternary titanium systems to find intermetallic compounds of ABC, AB_2C, and $A_6B_{16}C_7$ alloys of the following ternary systems: Ti-Co-Al, Ti-Fe(Co, Ni, Cu)-Ga, Ti-Fe(Co, Ni, Cu)-In, Ti-Co(Ni)-Si, Ti-Fe(Co, Ni)-Ge, Ti-Fe(Co, Ni, Cu)-Sn, and Ti-Fe(Co, Ni, Cu)-Sb. R.N.A.

N67-11772*# Israel Program for Scientific Translations, Ltd., Jerusalem.

A REVIEW OF INVESTIGATIONS OF THE PHASE DIAGRAM OF THE BINARY Ti-Al SYSTEM

I. I. Kornilov, E. N. Pylaeva, and M. A. Volkova *In its* Titanium and Its Alloys 1966 p 76–88 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The results of previous investigations on Ti-Al alloy phase diagrams are discussed and compared. More recent studies show that the Ti-Al system contains: 1) an α-solid solution on the basis of titanium with 0 to 7.5% and 22.5 to 24.5% at 600°C, 2) a two-phase field $\alpha+Ti_3Al$ with 7.5 to 9.0% Al and a two-phase field $Ti_3Al+\alpha_2$ with 9 to 14% Al, and 3) two intermetallic compounds Ti_3Al with 9 weight % Al with a small field of homogenaity and a Ti_2Al compound with 15.8 weight % Al with a large field of homogeneity. The assumed presence of Ti_3Al and Ti_2Al compounds is confirmed by data on the elasticity coefficient of the alloys of this system. R.N.A.

N67-11773*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE PHASE COMPOSITION OF ALLOYS OF THE Ti-Al-Cr-Fe-Si SYSTEM WITH CONSTANT CONTENTS OF ALUMINUM (6%) AND SILICON (0.3%)

N. G. Boriskina and I. I. Kornilov *In its* Titanium and its Alloys 1966 p 88–98 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Determinations were made of the solubility of iron and chromium in the five component α- and β-solid solutions of titanium at 1100°, 1000°, 800°, and 500°C. Between 500° and 800°C, the α-solid solution of titanium with 6% Al and 0.3% Si can dissolve no more than 0.4% Fe+Cr. The phase transformations taking place in five component alloys at different temperatures of heat treatment are reflected by the changes in their hardness and electrical resistance. Author

N67-11774*# Israel Program for Scientific Translations, Ltd., Jerusalem.

DILATOMETRIC INVESTIGATION OF TITANIUM

R. S. Mints, A. E. Shelest, and Yu. S. Malkov *In its* Titanium and Its Alloys 1966 p 99–103 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The coefficient of linear expansion of metallic titanium and the kinetics of sintering compressed titanium powder were investigated with a high temperature vacuum dilatometer. The dilatometric study showed that the $\alpha \rightarrow \beta$ transformation of titanium is accompanied by a sharp volume decrease, a considerable consumption of heat, and the evolution of gaseous impurities. The magnitudes of the relative expansions and the coefficient of linear expansion of titanium forged at 400° and 1100° are tabulated. A curve of the cyclic sintering of titanium powder shows that with each subsequent heating cycle the degree of sintering increases and the shrinkage decreases. The titanium microstructure after repeated sintering is that of a compact metal with a small number of minute pores and can be forged. This cyclic sintering process may eventually replace the isothermal process of sintering. The requirements of the cyclic sintering thermal process may be determined from the dilatometric curve obtained by the dilatometer. The influence of various rates of heating and cooling on the sintering process also may be investigated. The repeated heating of a sintered specimen in a dilatometer may be used to check the degree of sintering. R.N.A.

N67-11775*# Israel Program for Scientific Translations, Ltd., Jerusalem.

KINETICS OF OXIDATION OF TECHNICALLY PURE TITANIUM IN THE AIR AT HIGH TEMPERATURES

S. A. Gorbunov and I. S. Anitov *In its* Titanium and its Alloys 1966 p 104–112 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The degree to which oxidation can take place and the depth of the gas saturated layers formed when technically pure titanium is heated in air at 800° to 1200°C were investigated. At 1100° to 1200°C the following changes take place: 1) the structure of the scale changes as shown by an agglomeration of the external layer, 2) the oxygen distribution between the scale and the gas saturated layer is changed, 3) the gas saturated layers grow thicker because of the growth of regions with a low oxygen content, 4) the equation representing the titanium oxidation changes from parabolic to an equation with a cubic exponent, and 5) the diffusion velocity of titanium ions to the specimen surface increases in the general process of oxidation. These facts indicate the titanium oxidation at 1100° to 1200°C is somewhat different than the process at 800° to 1000°C. These differences are apparently due to the increased velocity of diffusion of titanium ions to the oxide-air boundary and the agglomeration of the scale. R.N.A.

N67-11776*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE OXIDATION OF VT-14, VT-8, VT-3-1 ALLOYS AND OF NO. 1 EXPERIMENTAL ALLOY IN AIR AT 800 TO 1200°C

S. A. Gorbunov, G. P. Nedutenko, and V. P. Teodorovich *In its* Titanium and its Alloys 1966 p 113–121 refs (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

The kinetics of oxidation and formation of gas saturated layers of several titanium alloys in air at 800° to 1200°C were investigated and compared with data on technically pure titanium. The chemical compositions of the alloys are tabulated. The results are analyzed and expressed in kinetic curves of oxidation, tables showing the thickness of scale and the thickness of gas saturated layers on the alloys, and microhardness curves. R.N.A.

N67-11777*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE INFLUENCE OF GAS-SATURATED LAYERS ON THE STRENGTH AND PLASTIC PROPERTIES OF TITANIUM ALLOYS

L. A. Glikman, V. I. Deryabina, N. N. Kolgatin, I. A. Bytanskii, V. P. Teodorovich et al *In its* Titanium and its Alloys 1966 p 122–136 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

An investigation was conducted on the effect of the gas saturated layer formed during heating of titanium in air at 800° to 1100°C for 0.5 to 4 hours on the mechanical properties of several titanium alloys. The study shows that the titanium alloys form a gas saturated layer with a high hardness and a low plasticity on their surfaces at 800° to 1100°C. Their mechanical properties are considerably impaired by the gas saturated layer. The oxidation of the alloys at 1100°C reduces the strength characteristics by 40 to 60%, the impact toughness by 70 to 80%, while the plasticity drops to zero. The gas saturated alloys, whether bent or unbent, exhibit high notch sensitivity which, particularly in bent specimens, becomes evident after heating at low temperatures, i.e., when no oxygen saturated layer has yet been formed on the surface of the alloys. The mechanical properties of the gas saturated alloys can be restored to their initial levels if the oxygen saturated layer is mechanically removed. In order to restore the strength and plastic characteristics of the alloys, a layer 5 to 6 times as thick as the oxygen saturated layer must be removed together with the inclusions. R.N.A.

N67-11778*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CALCULATION OF THE KINETICS OF THE DISSOLUTION OF OXYGEN IN TITANIUM

S. S. Mozhaev and L. F. Sokiryanskii *In its* Titanium and Its Alloys 1966 p 137–150 refs (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

Several studies concerned with using mathematical analysis to investigate the dissolution kinetics of oxygen in titanium are reviewed. It is shown that in calculating the kinetics of oxygen dissolution in titanium, all physical assumptions must be verified in order to render the mathematical treatments more precise. Attention must also be given to the development of experimental methods to ensure a reliable determination of the diffusion constants. R.N.A.

N67-11779*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE INFLUENCE OF HYDROGEN ON THE TENDENCY OF TITANIUM ALLOYS TO DELAYED CRACKING

A. S. Mikhailov and B. S. Krylov *In its* Titanium and Its Alloys 1966 p 151–157 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF$2.00

The tendency of titanium alloys to delayed cracking was investigated using the method of prolonged bending. The method is based on the accelerated formation of cracks resulting from the prolonged action of additional stresses which act on the specimen both directly and indirectly by accelerating the decomposition of nonequilibrium phases or intensifying diffusion processes. The test was conducted by prolonged bending of specimens freely resting on two supports and having the load applied to their center. The study showed that a high hydrogen content may cause the formation of delayed cracks in the investigated alloys, which included VT-5-1, $TiAl_4Sn_6Cu_2$, OT-4, VT-4, OT-4-2, T-4, VT-6, and VT-14 alloys. The resistance of welded joints of most titanium alloys to delayed cracking is somewhat lower than that of the base metal. The opposite is true of VT-4 and T-4 alloys. All alloys with α or $\alpha+\beta$ phases and hydrogen contents above the critical limit developed cracks during prolonged bend tests irrespective of whether or not they contained a titanium hydride phase. Structures subjected to prolonged loading should be made of VT-5-1, $TiAl_4Sn_6Cu_2$, OT-4, or VT-14 alloys with hydrogen contents lower than 0.015%. R.N.A.

N67-11780*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE CORROSION RESISTANCE OF TITANIUM ALLOYS TO VARIOUS MEDIA IN THE CHEMICAL AND PHARMACEUTICAL INDUSTRIES

F. N. Tabadze, S. N. Mandzhgaladze, I. N. Lordkipanidze, and T. S. Dashniani *In its* Titanium and its Alloys 1966 p 158–161 (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

The corrosion resistances of VT-1, AT-3, AT-4, AT-6, AT-8, OT-4, and OT-40 titanium alloys were investigated in extracts and tinctures of galenica, and compared with the corrosion resistances of tinned copper and austenitic chromium nickel stainless steel. Results show that in tinctures of iodine, ammonium anisate, pectoral elixir, and ginseng, the corrosion resistance of AT alloys is 10 times higher than that of tinned copper. The corrosion resistance of AT alloys in extracts of digolen-neo, water pepper, and saturela hortensis is 15 times greater than that of tinned copper. Experiments conducted with aqueous solutions of tannin and gallic acid showed that AT alloys have a corrosion resistance 90 times higher than that of VT-1 alloy, 300 times higher than that of tinned copper, and 220 times higher than that of 1 Kh18N9T steel. Solutions of galencia in contact with OT-4 and OT-40 alloys caused a leaching out of manganese. R.N.A.

N67-11781*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CORROSION RESISTANCE OF AT TITANIUM ALLOYS TO MEDIA IN THE FOOD INDUSTRY

F. N. Tabadze and T. A. Lashkhi *In its* Titanium and its Alloys 1966 p 162–166 (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Corrosion tests were conducted under both laboratory and industrial conditions to determine the corrosion resistance of AT-3, AT-4, AT-6, and AT-8 titanium alloys in the presence of some characteristic foods. Results showed that all the alloys have good corrosion resistance to acetic and formic acids, as well as to technical solutions used in the wine, canned food, and tea industries. They also have good corrosion resistance to juices, pickles, and stewed fruits, and do not affect the chemical or physical properties of foods. The high corrosion resistance of AT-3 and AT-8 alloys was demonstrated in the production of caffeine, tartaric vinegar, and in cooling solutions used in breweries. The AT titanium alloys show great promise for use as equipment and apparatus in the food industry. R.N.A.

N67-11782*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE KINETICS OF EVOLUTION OF HYDROGEN IN VACUO FROM TITANIUM AND ITS ALLOYS

B. S. Krylov *In its* Titanium and its Alloys 1966 p 167–176 (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The process of hydrogen removal from technically pure titanium VT-1-1 and from OT-4 alloy in vacuo at various heating temperatures, surface conditions, and hydrogen contents was investigated. Results show that a relatively intense removal of hydrogen from the metal takes place at 650°C and higher. This process is considerably accelerated by an increase in temperature. The velocity of hydrogen evolution increases with its content in the alloy. The presence of a chromium-nickel coating or an oxidized layer on the metal surface leads to an inhibition of the degassing process. The duration of degassing, by which hydrogen is more or less fully removed from the VT-1 and OY-4 alloys, depends little on the dimensions of the specimens (with a thickness of up to 10 mm) or on the content and distribution of hydrogen in the metal. R.N.A.

N67-11783*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INVESTIGATION OF THE ELECTROCHEMICAL BEHAVIOR OF TITANIUM AND ITS ALLOYS DURING THE ELECTROLYSIS OF CHLORIDE SOLUTIONS

L. M. Yakimenko, G. N. Kozhanov, I. E. Veselovskaya, and R. V. Ozhegatspanyan *In its* Titanium and its Alloys 1966 p 177–185 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

An electrochemical investigation of titanium, niobium, tantalum, molybdenum, zirconium, and tungsten was conducted to determine their value as corrosion resistant anodic materials for use in the electrolysis of chloride solutions. In the industrial production of chlorine with titanium anodes, the anodic polarization produces a protective oxide film through which a residual current of 10^{-5} to 10^{-6} amp/cm^2 passes at a potential of 1.5 v. At this potential, the residual current on titanium is used for the evolution and oxidation of chlorine. An acceleration in chlorine evolution, accompanied in most cases by an acceleration in the anodic dissolution of the metal, can be attained by changing the chemical composition of the surface layer of titanium anodes. It was determined that titanium, tantalum, and niobium can be used for the electrolysis of chloride solutions either as unprotected anodes or as a basis for platinum electrodeposits. R.N.A.

N67-11784*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ELECTROCHEMICAL AND CORROGION INVESTIGATIONS OF Ti-Al ALLOYS

F. N. Tabadze, S. N. Mendzhgaladze, T. S. Dashniani, I. N. Lordkipanidze, and L. F. Tevadze *In its* Titanium and its Alloys 1966 p 186–188 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

A study was conducted on the electrochemical and corrosion resistant properties of 19 Ti-Al alloys with an Al content ranging from 0.5 to 38.5 weight %. The alloys were heat treated and exposed to corrosive media, including sulfuric acid, hydrochloric acid, nitric acid, and sodium chloride. Results show that alloys with up to 37.5 weight % Al are resistant to nitric acid except those with 6 to 7% Al which are uniformly attacked at a rate of 1.42 mm/yr. Only alloy groups with up to 6% Al, with 10 to 12% Al, or with more than 36% Al are sufficiently resistant ot sulfuric and hydrochloric acids. The notable variations in the electrochemical and corrosion properties of the Ti-Al alloys indicate that the latter contain phases which are more negative than the α-Ti solid solution. R.N.A.

N67-11785*# Israel Program for Scientific Translations, Ltd., Jerusalem.

CORROSION RESISTANCE AND ELECTROCHEMICAL BEHAVIOR OF TITANIUM AND ITS ALLOYS IN SOLUTIONS OF INORGANIC ACIDS CONTAINING OXIDATION AGENTS

F. A. Orlova and T. A. Tumanova *In its* Titanium and its Alloys 1966 p 189–198 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The electrochemical behavior of titanium and its alloys was studied in a specially designed electrolytic unit. Determinations were made of the corrosion velocity of titanium, the dependence of the potential on the duration of exposure, and the relation between the degree of corrosion and the nature of the oxidation agent. Results showed that only active oxidation agents such as humid chlorine and nitric acid can bring about a passivation of titanium in solutions of hydrochloric and sulfuric acids. Concentration and temperature ranges at which titanium and its alloys are resistant in solutions of hydrochloric and sulfuric acid containing chlorine were determined. Titanium is easily passivated in an 18% solution of hydrochloric acid at 90°C if the medium contains from 0.5 to 1.0% nitric acid. An increase in nitric acid up to 10% has almost no effect on the Ti potential, but at 20% HNO_3 the Ti potential rises markedly. Only the Ti alloy with 20% Ta is corrosion resistant at 90°C in an 18% solution of hydrochloric acid saturated with chlorine. Under these conditions the alloy's potential is positive while the potential of the unalloyed titanium is negative. R.N.A.

N67-11786*# Israel Program for Scientific Translations, Ltd., Jerusalem.

DEPENDENCE OF THE ELASTIC PROPERTIES OF TITANIUM ALLOYS ON THEIR COMPOSITION AND STRUCTURE

S.G. Fedotov *In its* Titanium and its Alloys 1966 p 199–215 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The dependence of elasticity constants on composition for alloys of the Ti-Mo, Ti-V, Ti-Nb, Ti-Al, and Ti-Sn systems were investigated over a wide range of compositions. Mo, V, and Nb were found to decrease the elasticity constants of annealed alloys in the field of homogeneous α-solid solutions and of two phase $\alpha+\beta$ compositions. The Young modulus and the shear modulus are greatly affected by the structure of alloys hardened from the β field. The metastable α and β phases have the lowest elastic properties while the phase is characterized by the highest elasticity constants. Al sharply increases the elasticity constants of Ti alloys. By alloying with Al, the elasticity constants of Ti can be almost doubled while their specific gravity is decreased. Sn has little affect on the elasticity constants of α-solid solutions at room temperature. However, in α-solid solutions of Ti with greater amounts of Sn, the elastic properties decrease less upon heating and the Poisson ratio has a more stable value than in Ti alloys with little Sn or in pure Ti. R.N.A.

N67-11787*# Israel Program for Scientific Translations, Ltd. Jerusalem.

INVESTIGATION OF THE HEAT RESISTANCE OF ALLOYS OF THE Ti-Al-Sn SYSTEM BY THE BENDING METHOD

I. I. Kornilov and T. T. Nartova *In its* Titanium and its Alloys 1966 p 216–220 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The results of an investigation of the heat resistance of Ti-Al-Sn alloys by the centrifugal-bending method showed that alloys containing intermetallic solid solutions and those in the vicinity of the maximum solubility of solid solutions based on α-Ti and on Ti-Al-Sn intermetallic compounds have a very high heat resistance. The composition versus properties diagrams of these alloys belong to those of the second type. Alloys of the Ti_3Al-Ti_3Sn section with continuous solid solutions of these two intermetallic compounds show a linear relationship between the heat resistance and the composition of the alloys. The composition-property diagram corresponds to those of the first type. The TiAl-base alloys have the highest heat resistance among all the Ti-Al-Sn alloys investigated. Author

N67-11788*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MECHANICAL PROPERTIES OF AT-3, AT-4, AT-6, AND AT-8 HEAT TREATED TITANIUM ALLOYS

B. K. Vul'f and S. A. Yudina *In its* Titanium and Its Alloys 1966 p 221–228 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The effect of heat treatment on changes in phase composition, microstructure, and mechanical properties of AT-3, AT-4, AT-6, and AT-8 titanium alloys was investigated. Results show that AT-6 alloys hardened in air from 700° to 1150°C have almost the same strength, hardness, and impact toughness. The reduction of area for AT-6 increases up to a hardening temperature of 850° to 875°C, which is close to the two phase field boundary of the phase diagram, after which it sharply decreases. To a lesser degree this also holds for elongation. Aging at 400°, 450°, and 550°C has little effect on the mechanical properties of AT-6. The ultimate strength of hardened AT alloys increases with Al content, while the plasticity decreases. Except for AT-8, these alloys are not embrittled by aging. The properties of all the AT alloys change in the same way as those of AT-6. For the best combination of strength and plasticity in air hardened alloys, the following hardening temperatures are recommended: 800° to 850°C for AT-3, 850° to 870°C for AT-4, 850° to 875°C for AT-6, and 925° to 950°C for AT-8. R.N.A.

N67-11789*# Israel Program for Scientific Translations, Ltd., Jerusalem.

HEAT RESISTANCE, CREEP, AND THERMAL STABILITY OF THE AT-3 ALLOY

V. S. Mikheev, K. P. Markovich, and Z. G. Friedman *In its* Titanium and Its Alloys 1966 p 229–232 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Heat resistance of the AT-3 alloy was investigated by determining the long time strength at 350°C and under different stresses. A 3500 hr test with a 55 kg/mm^2 load did not lead to failure. Creep was also investigated in this alloy at 350°C and under different stresses. Creep curves show that under loads of 30, 37, and 45 kg/mm^2, the residual deformation of the alloy varies little. An investigation of the aging process at 350° and 400°C for 5000 and 3000 hrs, respectively, showed that both plasticity and ultimate strength remained unchanged. To establish the alloy's thermal stability, its mechanical properties were determined after a 5000 hr creep test at 300°C and 30 kg/mm^2, and after 6600 hrs at 350°C and 30 kg/mm^2. Data show that the loaded alloy remained unembrittled, the strength remained as in the initial condition, and plasticity increased somewhat. Thermal stability was also tested under conditions of cyclic heating and cooling without applying stress. Results show that the alloy retained satisfactory mechanical properties, was thermally stable at 300° to 400°C, and was not embrittled. R.N.A.

N67-11790*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE COMPOSITION AND PROPERTIES OF INDUSTRIAL MELTS OF THE AT-3 TITANIUM ALLOYS

V. A. Livanov, N. M. Kaleshyan, S. M. Fainbron, and R. M. Ryabova *In its* Titanium and its Alloys 1966 p 233–238 (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

To develop production technology for parts to be made from a titanium alloy containing 3% aluminum, an ingot of the alloy was studied whose upper, middle, and lower parts consist of an α-solid solution. A fine grained uniform macrostructure is found under cast, drop, forged, and press forged conditions; and increasing the temperature in drop and press forging has little influence on the structure. Uniform and stable mechanical properties are found, although a certain anisotropy of the mechanical properties can be found in 160, 100, and 65 mm diameter rods of the alloy. This is attributed to the presence of inclusions located in a direction parallel to that of the deformation of the metal. Thermal stability of the alloy is good from 400 to 450°C, and embrittlement does not occur following heating at this temperature for 100 hours. M.W.R.

N67-11791*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE DEPENDENCE OF THE MECHANICAL PROPERTIES AND HEAT RESISTANCE OF AT-TITANIUM ALLOYS ON THE TEMPERATURE

L. P. Nikitina *In its* Titanium and its Alloys 1966 p 239–249 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Short and long term strength, deformability at constant deformation rate, notch sensitivity, creep resistance, and aging are discussed for the AT-3 titanium alloy which is considered stronger than many α-titanium alloys. Structural stability and good heat resistance at temperatures up to 400°C make the alloy fit for high temperature service under stresses for more than 5,000 hours. At higher temperatures, there is considerable weakening and decrease in plastic properties and toughness. Yield point and ultimate strength are fairly close in the AT-3 alloy, which results in stress sensitivity and cracking danger. M.W.R.

N67-11792*# Israel Program for Scientific Translations, Ltd., Jerusalem.

A COMPARISON OF THE HEAT RESISTANCE OF SOME TITANIUM ALLOYS AT 450–700°C

I. I. Kornilov, V. S. Mikheev, O. N. Andreev, and P. S. Maiboroda *In its* Titanium and its Alloys 1966 p 250–261 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Several industrial and experimental titanium alloys were tested by a centrifugal method at temperatures from 450 to 700°C to determine their heat resistance. Technically pure titanium (VT-1) has a high creep and is not considered heat resistant at the lowest temperature. Ternary alloys of Ti-Al-Mn with two-phase structure have a lower heat resistance at 450°C than six-component Ti alloys. Despite their two-phase structure, these alloys containing Mn have a lower temperature of eutectoid transformation and lower heat resistance than a ternary α-alloy of Ti-Al-Sn. A ternary alloy with Ti-Al-V (VT-6) exhibits lower heat resistance because its β-structure increases with temperature. The AT-3 alloys display high heat resistance at temperatures up to 600°C. At 600 to 700°C, the most heat resisting alloys are those with an α-phase and with seven or eight alloying elements. An experimental alloy, designated Ti_3Al, has a particularly high heat resistance. M.W.R.

N67-11793*# Israel Program for Scientific Translations, Ltd., Jerusalem.

ALTERATIONS IN THE MECHANICAL PROPERTIES OF THE AT-3 ALLOY AFTER COLD WORKING AND ANNEALING

A. E. Shelest, Z. S. Falaleeva, and I. M. Pavlov *In its* Titanium and its Alloys 1966 p 262–267 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Various sections cut from a sheet of AT-3, a titanium alloy with Al-Cr-Fe-Si-B, did not behave the same way during rolling. Specimens from the sheet edges, for example, were stronger and more difficult to cold roll. In order to provide data for use in the development of a process which results in more uniform sheets, X-ray analysis was made of the alloy after it underwent various treatments. This revealed that the alloy was already work hardened, and annealing for one hour at 750°C and cooling in air did not result in full recrystallization; at 800°C recrystallization did take place following different modes of cooling after annealing. Prolonged annealing of AT-3 at 700 to 800°C leads to the formation of an equilibrium α-phase with small intermetallic inclusions of $TiCr_2$. Ordinarily AT-3 is a solid solution, and annealing of deformed specimens at 500 to 650°C leads to the decomposition of this solid solution. Differences between deformation by rolling and bending are discussed. M.W.R.

N67-11794*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE ACTIVATION ENERGY OF CREEP AND THE MECHANISM OF PLASTIC DEFORMATION OF TITANIUM ALLOYS

I. I. Kornilov, A. Ya. Shinyaev, and O. N. Andreev *In its* Titanium and its Alloys 1966 p 268–270 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Temperature-versus-rate of creep curves constructed in semilogarithmic coordinates for several titanium alloys result in straight lines which are parallel to each other. The activation energy of creep calculated from these lines is, therefore, the same for all the alloys, or 34 kcal/mole. It is concluded that the addition of as much as 10% Al, Cr, or other alloying element to the titanium alloy has little influence on the activation energy of creep. Decrease in rate of plastic deformation is more rapid at higher temperatures for Ti alloys, and this decrease is attributed to a decrease in the number of active centers of the material. M.W.R.

N67-11796*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE INFLUENCE OF HEATING IN DIFFERENT GASES ON THE TOUGHNESS (IMPACT STRENGTH) OF COMMERCIAL TITANIUM

A. P. Gulyaev, A. E. Shelest, V. I. Mishin, N. N. Kossakovskaya, and I. M. Pavlov *In its* Titanium and its Alloys 1966 p 279–282 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Impact strength of titanium remains high as a result of vacuum heating, and heating time has little influence on strength. Heating in air above 800°C decreases the impact strength of the metal to a greater extent than heating at the same temperature in either nitrogen or pure oxygen. Increase in impact strength after heating from 700 to 800°C results from recrystallization which increases the plastic properties of titanium. M.W.R.

N67-11798*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PHASE TRANSFORMATION IN THE HEAT-AFFECTED ZONE OF α-TITANIUM AND $\alpha+\beta$-TITANIUM ALLOYS AND THE CRITERIA FOR CHOOSING THE WELDING PROCESSES

M. Kh. Shorshorov and G. V. Nazarov *In its* Titanium and its Alloys 1966 p 297–302 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Characteristics of phase transformations are discussed for a number of titanium alloys which are subjected to conditions of continuous cooling during welding; and the anisothermal transformations VT-5-1 and VT-14-1 alloys are plotted to show the beginning and end of transformation and the beginning of the hydride formation. Influence of the alloy composition and of the parameters of the thermal cycle of welding on the structure and mechanical properties of the heat-affected zone is discussed and illustrated. M.W.R.

N67-11799*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE MECHANISM OF DELAYED FAILURE AND THE FORMATION OF COLD CRACKS DURING WELDING OF TITANIUM ALLOYS AND OF STEELS

M. Kh. Shorshorov, G. V. Nazarov, and V. V. Belov *In its* Titanium and its Alloys 1966 p 303–311 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Generalizations are offered for the occurrence of delayed failures and crack formations during the welding of titanium alloys and hardenable steels. In welded steels and titanium alloys the formation of cold cracks in the welding zone is more intense than in hardened steel; and this is attributed to both the higher heating temperature and a considerable segregation of harmful impurities along the grain boundaries during grain growth. Sometimes a fusion of impurities occurs which leads to a sharp decrease in the intercrystalline strength. The effect of impurities is less in hardened steels. Difference in tendencies to delayed failures and crack formation is related to number and lower concentration of stresses, the rate of hydride formation, and relaxation of stresses. Microscopic analysis indicates that in titanium alloys the beginnings of cracks are not located strictly along the grain boundaries as is the case for steels. A vacancy mechanism, which explains the formation of microvoids, provides a basis for existing theories that explain the influence of hydrogen on the brittleness of metals. M.W.R.

N67-11800*# Israel Program for Scientific Translations, Ltd., Jerusalem.

METASTABLE STRUCTURAL TRANSFORMATIONS AND THEIR INFLUENCE ON THE PROPERTIES OF $\alpha+\beta$-TITANIUM ALLOYS

E. A. Vinogradova, N. F. Lashko, and V. N. Moiseev *In its* Titanium and its Alloys 1966 p 312–319 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

The alpha and beta phases of some titanium alloys were subjected to X-ray investigations using radioactive copper to determine the influence of various metastable transformations on the alloys. Decrease in yield point of a VT-14 alloy during tension tests is connected with increasing amount of metastable beta phase which decomposes during plastic deformation. A VT-14-1 alloy, which has a higher degree of alloying than VT-14, contains a greater variety of phases and more β-phase isomorphic Mo and V. Metastable structural transformations during plastic deformation are discussed, including the reversibility of the alpha and beta transformation. The VT-14-1 alloy, when hardened at 750°C and with plastic deformation of about 25%, exhibits a decrease in ultimate strength and an increase in elongation due to the formation of a metastable α-phase. M.W.R.

N67-11801*# Israel Program for Scientific Translations, Ltd., Jerusalem.

MECHANICAL PROPERTIES OF TI-CR-FE, TITANIUM-RICH ALLOYS (PHASE DIAGRAM SECTIONS WITH 0.5 and 1.5% FE)

N. G. Boriskina and I. I. Kornilov *In its* Titanium and its Alloys 1966 p 320–327 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Mechanical properties of Ti-Fe-Cr titanium alloys containing 1.5% Fe are changed during preliminary heat treatment at both room and elevated temperatures because of the formation of different alpha to beta solid solution ratios and different content of $TiCr_2$. Quenching from 750°C is found to be the most favorable heat treatment for alloys with either 1.5 or 0.5% Fe in that optimum properties result at both room temperature and at 450°C. Highest heat resistance results at 450°C and under 15 kg/mm^2 loads and a 5mm deflection could not be produced in these alloys after a 150-hour test. M.W.R.

N67-11802*# Israel Program for Scientific Translations, Ltd., Jerusalem.

HYDROGEN EMBRITTLEMENT OF TITANIUM ALLOYS

V. A. Livanov, A. A. Bukhanova, B. A. Kolachev, and N. Ya. Gusel'nikov *In its* Titanium and its Alloys 1966 p 328–338 refs (See N67-11761 02-17) CFSTI: HC $7.00/MF $2.00

Hydrogen embrittlement of $\alpha+\beta$-titanium alloys appears at low rates of deformation and is promoted by low testing temperatures and by notches. Further, hydrogen embrittlement occurs in the dual phase alloy if the hydrogen content exceeds a certain limit that is usually much greater than the maximum permitted by technical specifications. In the case of hardened titanium (VT-3-1) alloys, embrittlement takes place with the lowest investigated concentration of hydrogen (0.01%); in the former it does not take place at 0.03%. Decrease in plasticity, which occurs during aging at room temperature rather than immediately after hardening; and in the $\alpha+\beta$ alloys is accompanied by considerable strengthening.

The α-titanium alloys are also prone to hydrogen embrittlement in the same way as the dual phase alloys; and in both instances a redistribution of hydrogen under the influences of applied stresses is implicated. M.W.R.

N67-11804*# Israel Program for Scientific Translations, Ltd., Jerusalem.
AT-3, AT-4, AT-6, AND VT-3-1 TITANIUM ALLOYS USED IN THE PRODUCTION OF COMPRESSOR ROTORS (IMPELLERS) OPERATING IN DIFFERENT CORROSIVE MEDIA
N. I. Belan, M. S. Borisova, B. M. Idel'chik, and A. A. Chikurova *In its* Titanium and its Alloys 1966 p 344–353 (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

Heat treatment under optimum conditions does not affect the mechanical properties of several forgings of titanium alloys with varying amounts of Al, Cr, Mo, Si, Fe, and/or B. Plasticity increases when temperature is decreased during short-term tension tests; and impact strengths of these alloys when temperatures are decreased between +20 and −180°C. High corrosion resistance to aqueous solutions saturated with hydrogen sulfide, hydrochloric acid solutions, and certain industrial atmospheres is exhibited by most of the alloys; and results with regard to corrosion resistance are presented for various temperatures, contact solutions, and other conditions. Time to failure of the titanium alloys, into which hydrogen was introduced by electrolysis simultaneously with tensile stresses between 40 and 55 kg/mm^2 varies from 21 to 50 hours. M.W.R.

N67-11805*# Israel Program for Scientific Translations, Ltd., Jerusalem.
HEATING AND COOLING OF SPECIMENS OF TITANIUM AND ITS ALLOYS
D. V. Budrin, E. L. Sukhanov, and V. I. Shilov *In its* Titanium and its Alloys 1966 p 354–360 refs (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

Annealing and hot working of specimens of commercially pure titanium, three titanium alloys, and a steel were investigated. Time required to heat and cool two of the Ti alloys was about half that required for the steel; another Ti alloy, which contains Mo, and the pure Ti displayed temperature times midway between the steel and the two Ti alloys. Formulas are given to represent the heating and cooling processes and the coefficients of thermal conductivity and diffusivity; and the method employed is described. M.W.R.

N67-11806*# Israel Program for Scientific Translations, Ltd., Jerusalem.
OXIDATION OF TITANIUM AND ITS PROTECTION AGAINST GAS CORROSION
D. V. Ignatov *In its* Titanium and its Alloys 1966 p 361–367 refs (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

Oxidation of titanium and some of its alloys, and as the structures of the oxides which result are considered. Between 600 and 700°C the titanium is more rapidly oxidized in oxygen than in air; and oxidation rate begins to increase considerably at 720°C. The Ti alloy with 15% V begins to oxidize intensively at 550°C, whereas alloys with 15% Mo do not begin their rapid increase until 650°C. At 800°C, the oxidation rate begins to decrease for the latter. The lower rate of oxidation for this alloy and another one designated AT-8 is attributed to an increase in the temperature of reversible alpha-beta transformation as well as decrease in the solubility of the Ti itself. Aluminum is found to strengthen the bonds in the Ti crystal lattice and inhibit the penetration of oxygen. It is recommended that when Ti or its alloys are to be used at temperatures between 700 and 900°C, an Al-Ni coating be used; and that the Ti should be alloyed with elements that strengthen the α and β phases by forming intermetallic compounds such as TiAl, $NbAl_3$, and $MoAl_3$. M.W.R.

N67-11807*# Israel Program for Scientific Translations, Ltd., Jerusalem.
SHORT-TERM AND LONG-TERM (CREEP) STRENGTH OF SIX-COMPONENT TITANIUM ALLOYS AT-3, AT-4, AT-6, AND AT-8 (ACCORDING TO DATA OBTAINED WITH INDUSTRIAL MELTS)
V. A. Livanov, V. S. Mikheev, S. M. Fainbron, A. A. Kutsenko, and S. E. Ivanova *In its* Titanium and its Alloys 1966 p 368–379 refs (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

Industrial melts of several titanium alloys were observed at temperatures between 400 and 600°C, and loads between 15 and 55 kg/mm^2. High strength at room temperature is displayed by multi-component Ti alloys (AT variety) with a 3 to 7.5% Al and a total Cr-Fe-Si content between 1.5 and 1.8%. Plasticity of these alloys decreases as Al content increases, and elongation decreases as much as 15%. Temperature weakening also increases with increasing Al content, although these AT alloys exhibit a high heat resistance between 400 and 600°C. Annealing temperature considerably influences time to failure; and depending on alloy content, the best annealing temperature is between 850 and 950°C. M.W.R.

N67-11808*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE INVESTIGATION OF THE PROPERTIES OF AT-4 TITANIUM ALLOYS AND THEIR USE IN THE MANUFACTURE OF TUBES
V. Ya. Ostrenko, E. P. Akimova, and L. A. Il'vovskaya *In its* Titanium and Its Alloys 1966 p 380–384 (See N67-11761 02-17) CFSTI: HC$7.00/MF$2.00

An AT-4 Ti alloy (with Al to stabilize its α phase and Cr, Fe, and Si to stabilize its β-phase) is satisfactory for the production of industrial tubes. When these alloys are quenched from 870°C and aged for three hours, they are found to be sensitive to heat treatment; and microstructure and mechanical properties of the AT-4 alloy indicate that the $\alpha+\beta \rightarrow \beta$ transformation occurs at 975°C. At all testing temperatures, AT-4 specimens with an area reduction of 14% are of highter quality than carbon steel tube shells. M.W.R.

N67-11882# Illinois Univ., Urbana. Dept. of Physics.
LOW TEMPERATURE SPECIFIC HEAT OF Sn AND Sn–In ALLOYS
William Roy Wilkes Jul. 1966 107 p refs
(Contract DA-31-124-ARO(D)-359)
(AROD-2771-12; AD-639214) CFSTI: HC$4.00/MF$0.75

The normal state specific heats of pure tin and alloys consisting of 0.5, 1, 2, 4, and 6 atomic percent indium in tin have been measured between about 0.4 and 4.2 K. All of the alloys lie within the solid solubility limit of indium in tin. Measurements were made in an adiabatic calorimeter cooled by a He3 refrigerator, with the specimens magnetically quenched from the superconducting state. Additional cooling of some specimens was possible by adiabatic magnetization to achieve temperatures as low as 0.24 K. The results for pure tin are compared with recent data for the temperature coefficient of the normal electronic specific heat, gamma, and the Debye temperature, theta. The results for the alloys are interpreted in terms of the variation in gamma and theta, and comparisons are made with recent determinations of the variations of gamma and theta with increasing indium concentration. While the variation of theta is in reasonable agreement with reported values, the variation of gamma with increasing indium content is positive, in disagreement with previously reported data. The results are also discussed in the light of the theories of Markowitz and Kadanoff and of Ginsberg on the variation of the critical temperatures of superconductors with alloying. TAB

N67-11982# National Academy of Sciences—National Research Council, Washington, D. C.

EVALUATION TEST METHODS FOR BERYLLIUM

Mar. 1966 65 p refs

(Contract ARPA SD-118)

(MAB-205-M; AD-631183) CFSTI: HC $3.00/MF $0.75

The report was prepared to establish standardized methods and procedures for conducting mechanical property tests on beryllium. The data presented are restricted to information which is well established and accepted, but the report also identifies areas of testing controversy and highlights current technical needs in the testing area. The report attempts to document recommended methods, based on a review of the procedures used in a number of organizations. For various reasons, many will want to deviate from these methods. To permit reliable inter-comparisons between laboratories, standardized methods are needed; and it is hoped that for this reason these methods will be adopted. Recommended procedures for tensile, 3-point bend, 4-point bend and precision elastic limit tests are described. Author (TAB)

N67-11998# Netherlands Research Centre TNO for Shipbuilding and Navigation, Delft. Corrosion and Antifouling Dept.

CORROSION, SHIPBOTTOM PAINTS [CORROSIE, HUIDVERVEN]

H. C. Ekama Apr. 1966 13 p refs In DUTCH; ENGLISH summary

(TDCK-46170) CFSTI: HC $1.00/MF $0.50

The use of good surface preparation and shop coating before plating steel used in ship hulls in order to prevent corrosion and deterioration of the paints and antifouling compositions used to keep the hull in good condition, are discussed. L.S.

N67-12000# Aeronautical Research Council (Gt. Brit.)

THE ROLE OF COMPRESSIVE STRAIN IN THE LOAD AND STRAIN FATIGUE BEHAVIOUR OF H.46 AT ROOM TEMPERATURE

G. P. Tilly London, HMSO, 1966 39 p refs Supersedes NGTE-R-269; ARC-27144

(ARC-CP-844; NGTE-R-269; ARC-27144) CFSTI: HC $2.00/MF $0.50

Constant load amplitude and constant strain amplitude fatigue tests have been conducted on an 11% Cr steel (H.46) at frequencies of 7 c/hr and 10 c/min at room temperature. The rupture data of the two tests correlated closely for both frequencies in terms of maximum applied stress at 50% life, but the constant strain amplitude data exhibited enhanced endurances in terms of strain range at this life. In general, constant load amplitude fatigue appeared to be more damaging than constant strain at this temperature. The rate of strain accumulation of repeated tension load fatigue and static tensile stress tests was slower than for fully push-pull. Strain continued to accumulate in a tensile sense during reversed push-pull tests at 7 c/hr despite excess compressive stresses which were as much as 8% greater than the complementary tensile stresses, while cycles with 16.5% excess compressive stress produced compressive strain accumulation. Author

N67-12038# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.

COMPREHENSIVE CAVITATION DAMAGE DATA FOR WATER AND VARIOUS LIQUID METALS INCLUDING CORRELATIONS WITH MATERIAL AND FLUID PROPERTIES

Ramon Garcia (Ph.D. Thesis) Aug. 1966 423 p refs

(Grant NSF-G-22529)

(TR-6)

An investigation was conducted to determine the cavitation resistance of potentially useful alloys in room temperature water and high temperature liquid metals, and to determine material-fluid parameters to correlate damage and allow its a priori prediction. Ultrasonic induced cavitation studies were conducted in lead-bismuth alloy at 500° and 1500°F, in mercury at 70° and 500°F, in water at 70°F, and in lithium at 500° and 1500°F for a wide variety of materials including refractory alloys, steels, aluminum, brasses, copper, nickel, tool steels, plastics, etc. The detailed results for the various fluid-material-temperature combinations are discussed. R.N.A.

N67-12072*# IIT Research Inst. Chicago, Ill.

METAL CARBIDE-GRAPHITE COMPOSITES Quarterly Report, Aug. 1–Oct. 31, 1966

Y. Harada 27 Oct. 1966 24 p refs

(Contract NASr-65(09))

(NASA-CR-79757; QR-1) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Property investigations were conducted on TaC–C and NbC–C compositions of 50 to 90 wt% metal. Flexural tests at temperatures up to 2800°C, and compressive deformation studies at 2700°C were performed. Thermal expansion was measured in the range of room temperature to 2300°C, and electrical properties were evaluated. Measurements were also made to determine if the previously observed linear relationship between electrical conductivity and flexural strength for graphite matrix composites applied to materials of high metal carbide content. Among the most significant findings are: (1) In high carbide content composites the anisotropy ratio in flexural strength diminishes to 1.5. (2) Anisotropy in thermal expansion behavior diminishes with increasing carbide content. (3) Resistance to compressive deformation at high temperatures is greater for the TaC–C than for the NbC–C system. (4) A definite direct correlation exists between electrical and mechanical properties, and this relationsuip may be exploited as a method for determining degree and homogeneity of bonding. M.G.J.

N67-12122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A THEORY OF PARTICLE-PARTICLE INTERACTION DESCRIBING THE MECHANICAL PROPERTIES OF DENTAL AMALGAM

B. G. Moser and R. F. Landel *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 84–92 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Mechanical properties of dental amalgam are governed by the same parameters as those which determine the rheological behavior of other filled systems, and a theory of particle-particle interaction is proposed. Particle size, size distribution, and surface area and energy of the alloy affect the amalgam's properties; but all four are reflected by a single parameter, which is the sedimentation volume or the maximum volume fraction of loading. The properties vary with residual mercury, but all of them can be normalized into a single master curve by considering a reduced concentration scale. The best method for a good restoration is considered the careful expressing and condensing of excess mercury from amalgams. The amalgam mix is considered as a slurry of solid particles (silver) whose interstices are filled with a liquid (mercury). The technical background included is the result of research on the properties of powders as applied to composite solid propellants. M.W.R.

N67-12273*# Texaco Experiment, Inc., Richmond, Va.

INVESTIGATION OF FIBER SYSTEMS OF ABLATIVE MATERIALS Final Report

Gordon H. Miller and George C. Robinson, Jr. 30 Sep. 1965 173 p refs

(Contract NAS3-4196)

(NASA-CR-54722; TEI-TP-259) CFSTI: HC $5.00/MF $1.00 CSCL 11F

The desired properties for advanced fibers to be used as reinforcing agents for ablative composites were defined after

consideration of the ablation process and the anticipated environmental conditions in advanced thrust chambers of liquid-fuel rocket engines. Based on their physical properties and their calculated and experimentally determined resistance to the combustion products from H_2/F_2 or B_2H_6/OF_2 fuel-oxidizer combustions, graphite, tungsten-coated boron, TiC, TiB_2, ZrB_2, B_4C, ZrO_2, and carbon-coated boron were recommended. The feasibility of preparing fibers of graphite, tungsten-coated boron, TiB_2, TiC, and ZrB_2 by chemical vapor plating was investigated. The TiB_2 fibers had the highest strengths (up to 378 kpsi) and highest moduli (up to 84 million psi) of all the fiber materials investigated. Fibers of these materials were tested in an argon arc plasma to determine their chemical resistance to oxidizing media consisting of separately injected H_2O and BF_3. Author

N67-12291# Martin Co., Denver, Colo.
CRYOGENICS MATERIALS DATA HANDBOOK Progress Report
F. R. Schwartzberg, S. H. Osgood, R. D. Keys, and T. F. Kiefer Wright-Patterson AFB, Ohio, AF Mater. Lab., Mar. 1966 232 p refs Suppl. to ML-TDR-64-280 Revised
(Contract AF 33(657)-9161)
(PB-171809, Suppl. III; ML-TDR-64-280; PR-3; AD-633388) CFSTI: HC $6.00/MF $1.25

Fracture toughness data are presented for a variety of metals down to −423°F. The fracture mechanics concept is a stress analysis approach to the problem of brittle fracture that involves the amount of strain energy available and released in initiating and maintaining fast fracture. Graphs of ultimate yield strength, tensile strength, and elongation for 22 material and temper combinations are included. In addition to the property vs temperature data, bar graphs in the form of both strength and strength/density are presented. S.P.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N67-11235# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
PRELIMINARY RESEARCH ON POLYURETHANE LAMINATING SYSTEMS HAVING GOOD THERMAL AND MECHANICAL PROPERTIES Progress Report
H. J. Lee 2 Aug. 1966 10 p refs
(NAEC-AML-2492; AD-639581) CFSTI: HC $1.00/MF $0.50

The continuing studies on polyurethane systems for laminates of highly advantageous thermal and mechanical capabilities is discussed. Polymers possessing some properties superior to previous systems synthesized were investigated Author (TAB)

N67-11346*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WEAR AND FRICTION OF VARIOUS POLYMER LAMINATES IN LIQUID NITROGEN AND IN LIQUID HYDROGEN
Donald W. Wisander, Lawrence P. Ludwig, and Robert L. Johnson Washington, NASA, Nov. 1966 15 p refs
(NASA-TN-D-3706) CFSTI: HC $1.00/MF $0.50 CSCL 11I

Wear and friction of polymer laminates were determined in liquid nitrogen and liquid hydrogen. Polymers included polytetrafluoroethylene (PTFE), phenol formaldehyde (phenolic), epoxy-formaldehyde (epoxy), and melamine formaldehyde (melamine); fabrics included glass, graphite, cotton, and nylon. Wear and friction experiments were conducted with a 3/16-inch-radius hemispherically-tipped polymer laminate rider sliding on the flat surface of a rotating 304-stainless-steel disk. The sliding velocity was maintained at 2300 feet per minute. The polymer laminate riders were under a 1000-gram load against the disk. The results of the investigation indicate that a laminate of graphite fabric and phenolic resin is a potentially useful material for sliding contact in liquid nitrogen and that a laminate of glass fabric and PTFE resin is useful in liquid hydrogen. Wear and friction of the laminates were appreciably higher in liquid hydrogen than in liquid nitrogen. Author

N67-11892# Institute of Modern Languages, Inc., Washington, D. C.
ULTRAVIOLET LIGHT TRANSMISSION OF FLUOBERYLLATE GLASSES WITH SMALL ADDITIONS OF THE RARE EARTH FLUORIDES OF CERIUM GROUP [ULTRAFIOLETOVOUE SVETOPROPUSKANIE FTOROBERILLATNICH CTECOL C MALIMI DOBAVKAMI REDKOZEMELNICH FTORIDOV ZERIEVQI GRUPPI]
A. A. Margarian and N. M. Medvedev Ft. Belvoir, Va., Army Eng. Res. and Develop. Labs., Aug. 1966 14 p refs Transl. into ENGLISH from Armianskyi Khim. Zh. (Erevan), v. 19, no. 3, 1966 p 167–173
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1870-66; AD-638671) CFSTI: HC $1.00/MF $0.50

It has been shown that small additions of the rare earth fluorides of cerium group increases the ultraviolet light transmission of fluoberyllate glass. This phenomenon has been interpreted. The action of X-rays upon glass with samarium fluoride additions has been investigated and the observed phenomenon has been explained Author (TAB)

N67-11986*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
DEVELOPMENT OF CHARACTERIZED AND REPRODUCIBLE SYNTACTIC FOAM OF PHENOLIC NYLON FOR HEAT SHIELDS Final Report, 1 Feb.–31 Dec. 1965
L. B. Keller 31 Dec. 1965 209 p refs
(Contract NAS2-2739)
(NASA-CR-73041; P66-49) CFSTI: HC $6.00/MF $1.25 CSCL 11I

Nylon phenolic foam designated for use as an ablative heat shield in the Scout Re-Entry program was studied to determine its properties and uniformity. Also, the reproducibility of the materials and processes used in the manufacture of the Scout Nosecap were investigated intensively. Methods of upgrading raw materials and processes to produce an improved, more uniform nylon phenolic ablator were investigated. This work culminated in a revised formulation containing upgraded raw materials which was molded directly into the Scout Nosecap configurations by a new process. The micro-structure of the improved material was considerably more uniform than its forerunner. Porosity was reduced, compressive strength increased twofold and tensile strength increased fourfold. Thus, it is shown that uniformity of microstructure and the reduction of interconnected porosity improve the physical properties of low density ablators. Author

N67-12107*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CERAMIC RESEARCH
E. C. de Wys and M. H. Leipold *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 25–26 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Experimental research on the role of grain boundaries and their associated impurities on the mechanical behavior of polycrystalline ceramics are briefly reviewed. It is reported that the development of preferred orientation during grain growth in hot-pressed MgO was detected by a standard proportional counter transmission

technique. Figures are included which depict the [100] pole figure parallel to the axis of hot pressed MgO rod, and the [100] pole figure at 90° to the axis of the pressed MgO rod. These show that an orientation mechanism accompanied the grain growth; however, optical examination of the grain structure did not reveal an elongated shape. From the data, it was indicated that the majority of the [100] poles are confined to a 30° arc from the thermal gradient direction. M.G.J.

N67-12121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEGREE OF CROSSLINKING OF STYRENE BUTADIENE RUBBER GLASS BEAD COMPOSITES
R. F. Fedors and R. F. Landel *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 80-83 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Origin of error in the value for the concentration of effective network chains (v_e) is calculated from swelling measurements for styrene-butadiene rubber (SBR) glass bead composites. Equations are given for the calculation of v_e for unfilled elastomers and for systems containing fillers. Volume fraction of the rubber in the swollen gel at equilibrium increases, while the apparent volume fraction of rubber in the swollen composite decreases as the filler fraction volume increases. While it is suggested that the increase in the gel may be due to inadequacy of the mathematical models used, it is considered possible that degree of crosslinking in the binder phase may increase with increasing filler fraction volume. Applicability of the equations is investigated, however, assuming that (1) the presence of one particle does not influence the swelling behavior of the binder in the vicinity of the neighboring particles and (2) no particle agglomeration exists. Following this analysis, it is concluded that for the SBR-glass bead composites, and possibly for others, the increase in gel fraction results from particle agglomeration or clustering. M.W.R.

N67-12125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STUDIES ON STERILIZABLE ELASTOMERS
E. F. Cuddihy and J. Moacanin *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 98-103 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A sterilizable elastomer, which cures slowly at 146°C, was prepared from carboxyl-terminated polybutadiene and a diimine curative. Feasibility of preparing elastomers which cure quickly and preserve their properties during sterilization was demonstrated by using the same prepolymer with a mixed imine curative. The elastomer was prepared using a fixed quantity of the curative and a varying amount of prepolymer, and quick curing was achieved in one hour at 146°C. Hardness curves are plotted for the resulting polymers. M.W.R.

N67-12229*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POLYURETHANE ELASTOMERIC COMPOUND CPS 796-80, TYPE III Qualification Test Report
Raymond H. Flack 8 Jul. 1966 25 p
(NASA-TM-X-57998; ESE-Q-74) CFSTI: HC $1.00/MF $0.50 CSCL 11J

Results are presented of qualification tests of a polyurethane elastomeric compound. This is a high temperature resistant, flexible, potting and molding material for encapsulating connectors, printed circuit boards, and compounds. The evaluation consisted of determining the following parameters: dielectric constant and power factor, dielectric strength, volume resistivity, surface resistivity, arc resistance, insulation resistance, high potential, low temperature flexibility, temperature resistance, tear resistance, moisture resistance, tensile strength and elongation, shrinkage, compression set, nonvolatile content, viscosity, specific gravity, application life, hardness, and adhesion. C.T.C.

N67-12265*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
EVALUATION POLYURETHANE ELASTOMERIC COMPOUND CS-3547, TYPE III
Raymond H. Flack 28 Jul. 1966 25 p
(NASA-TM-X-59137; ESE-E-58) CFSTI: HC $1.00/MF $0.50 CSCL 11J

Data from qualification tests are presented and discussed for the high temperature resistant, flexible, potting and molding compound, to be used for encapsulating connectors, printed circuit boards, and components. Among the properties tested were: dielectric constant and strength; resistivity; flexibility; temperature, tear and moisture resistance; tensile strength and elongation; shrinkage, viscosity, specific gravity, hardness, and adhesiveness. It was concluded that the polyurethane elastomeric compound met the specification requirements. N.E.N.

N67-12266*# National Aeronautics and Space Administration, Marshall Space Flight Center, Greenbelt, Md.
EVALUATION POLYURETHANE ELASTOMERIC COMPOUND CPS-796-65, TYPE II
Raymond H. Flack 28 Jul. 1966 26 p
(NASA-TM-X-59136; ESE-E-73) CFSTI: HC $2.00/MF $0.50 CSCL 11J

The qualification tests were performed on the CPS-796-65 polyurethane elastomeric compound type II with the following exceptions: (1) only samples of the two-part (A and B) kits were tested; (2) shelf life tests were not conducted; and (3) fungus and ozone resistance tests were waived. The series of tests have shown that the CPS-796-65 compound has met the requirements of the specification and is recommended for addition to the qualified products list. Author

N67-12267*# National Aeronautics and Space Administration, Marshall Space Flight Center, Greenbelt, Md.
EVALUATION POLYURETHANE ELASTOMERIC COMPOUND URALANE 5712, TYPE III
Raymond H. Flack 28 Jul. 1966 26 p
(NASA-TM-X-59135; ESE-E-19) CFSTI: HC $2.00/MF $0.50 CSCL 11J

These qualification tests were performed on the polyurethane elastomeric compound, type III with the following exceptions: (1) only samples of the two-part (A and B) kits were tested; (2) shelf life tests were not conducted; and (3) fungus and ozone resistance tests were waived. The series of tests have shown that the *Uralane* 5712 has met the requirements of the specification and is recommended for addition to the qualified products list. Author

N67-12276*# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
RESEARCH SUMMARY ON FRACTURE OF SWOLLEN RUBBER
H. K. Mueller Nov. 1966 7 p refs
(Grant NsG-172-60)
(NASA-CR-80195; GALCIT-SM-66-16) CFSTI: HC $1.00/MF $0.50 CSCL 11J

The characteristics of a Solithane 50/50 swollen with Toluene and initial results of crack propagation tests are reported. Stress-strain curves are graphed. Data indicated that the internal viscosity is largely reduced by swelling. Results of tests indicate that there is a critical strain at which the crack starts to propagate at high speed and that the strain history affects this critical strain. It was also found that the critical strain could be raised if the strain was held constant at a level slightly below the critical strain. N.E.N.

N67-12282# Naval Supply Research and Development Facility, Bayonne, N. J.
PPX-A NEW DYEABLE POLYPROPYLENE FIBER

Jack J. Press Jul. 1966 15 p refs
(AD-637875) CFSTI: HC $1.00/MF $0.50

A laboratory dyeability evaluation of a new dyeable polypropylene fiber was made to determine its potential for military and civilian textile use. Disperse and premetallized dyes are applied by a simultaneous scouring and dyeing process. Disperse dyeings show good yield and fair to good fastness. Selected dyes give high brightness. The premetallized dyes, in light and dark shades, give level dyeings with good yield and very high fastness. Most surprising is the high affinity of the fiber for vat dyes. Applied by a simple process, vat dyes give good yield and brightness and exceptional fastness. The fiber is also dyeable with acid dyes. Analysis of the findings for the new dyeable polypropylene fiber, show it to have considerable promise to meet the processing and color performance requirements for a wide range of end uses, including exacting military applications. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N67-11240# Stanford Univ., Calif. Dept. of Computer Science.
TODAY'S COMPUTATIONAL METHODS OF LINEAR ALGEBRA
George E. Forsythe 11 Aug. 1966 51 p refs Presented at the Natl. Meeting of SIAM, Iowa City, Iowa, 13 May 1966
(Contract Nonr-225(37))
(CS46; AD-638809) CFSTI: HC $3.00/MF $0.50

This is a survey of selected computational aspects of linear algebra, addressed to the nonspecialist in numerical analysis. Some current methods of solving systems of linear equations, and computing eigenvalues of symmetric and unsymmetric matrices are outlined. A bibliography containing 62 titles is included. Author (TAB)

N67-11248# Stanford Univ., Calif. Dept. of Computer Science.
TWO WORKING ALGORITHMS FOR THE EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX
W. Kahan and J. Varah 1 Aug. 1966 32 p refs
(Contract Nonr-225(37))
(CS43; AD-638798) CFSTI: HC $2.00/MF $0.50

Two tested programs are supplied to find the eigenvalues of a symmetric tridiagonal matrix. One program uses a square-root-free version of the QR algorithm. The other uses a compact kind of Sturm sequence algorithm. These programs are faster and more accurate than the other comparable programs published previously with which they have been compared. Author (TAB)

N67-11298# Stanford Univ., Calif. Computer Science Dept.
RELAXATION METHODS FOR SEMI-DEFINITE SYSTEMS
W. Kahan 9 Aug. 1966 35 p refs
(Contract Nonr-225(37))
(CS45; AD-638799) CFSTI: HC $2.00/MF $0.50

Certain non-stationary relaxation iterations, which are commonly applied to positive definite symmetric systems of linear equations, are also applicable to a semi-definite system provided that system is consistent. Some of the convergence theory of the former application is herein extended to the latter application. The effects of rounding errors and of inconsistency are discussed too, but with few helpful conclusions. Finally, the application of these relaxation iterations to an indefinite system is shown here to be ill-advised because these iterations will almost certainly diverge exponentially. Author (TAB)

N67-11300# Case Inst. of Tech., Cleveland, Ohio.
SOME VARIATIONS ON THE USE OF BUTTERWORTH POLYNOMIALS Scientific Report No. 12
William E. Blum Jun. 1966 33 p refs
(Contract AF 19(628)-1699)
(AFCRL-66-324; AD-639578) CFSTI: HC $2.00/MF $0.50

After reviewing the conventional use of Butterworth polynomials, a new technique is proposed which employs the sum and difference of such polynomials. These sums and differences are used to form rational functions which approximate certain transfer characteristics. All these new approximations are shown to be realizable as the transfer function of a three-terminal RLC network. From this work emerges the interesting fact that the weighted sum of two consecutive Butterworth polynomials is Hurwitz, i.e., B sub n (s) + alpha B sub n-1 (s) is Hurwitz for all alpha 0. Author (TAB)

N67-11352*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ESTIMATION OF PARAMETERS IN COMPOUND WEIBULL DISTRIBUTIONS
Lee W. Falls 30 Mar. 1966 43 p refs
(NASA-TM-X-53422) CFSTI: HC $2.00/MF $0.50 CSCL 12A

The two-parameter Weibull distribution has been recognized as a useful model for survival populations associated with reliability studies and life testing experiments. In the analysis of atmospheric data, the distributions encountered are often a result of combining two or more component distributions. These compound distributions are consequently of interest to aerospace scientists. Presented is a method for estimation of the parameters of a compound Weibull distribution with two shape parameters, two scale parameters, and a proportionality factor. The most general case of estimation will be considered in addition to a number of special cases that may be of practical value. Author

N67-11689*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
SIP MATRIX INVERSION
E. Y. Rodin 23 Nov. 1965 97 p refs
(Contract NAS8-11217)
(NASA-CR-79624; WR-65-38) CFSTI: HC $3.00/MF $0.75 CSCL 12A

A matrix inversion scheme, SIP, is introduced. It is a combination of inversion by submatrices and of iterative inversion. Several variants of the scheme are given, together with examples of success and of failure. The report also contains a survey of significant analytical inversion techniques. Author

N67-11886# Stanford Univ., Calif. Computer Science Dept.
HOW DO YOU SOLVE A QUADRATIC EQUATION
George E. Forsythe 16 Jun. 1966 22 p
(Contract Nonr-225(37))
(CS40; AD-639052) CFSTI: HC $1.00/MF $0.50

The nature of the floating-point number system of digital computers is explained to a reader whose university mathematical background is very limited. The possibly large errors in using mathematical algorithms blindly with floating-point computation are illustrated by the formula for solving a quadratic equation. An accurate way of solving a quadratic is outlined. A few general remarks are made about computational mathematics, including the backwards analysis of rounding error. Author (TAB)

N67-11936# Stanford Univ., Calif. Dept. of Computer Science.
WHEN TO NEGLECT OFF-DIAGONAL ELEMENTS OF SYMMETRIC TRI-DIAGONAL MATRICES
W. Kahan Jul. 1966 13 p refs Prepared in Cooperation with Toronto Univ.
(Contract Nonr-225(37))
(CS42; AD-638797) CFSTI: HC $1.00/MF $0.50

Given a tolerance E>0, the author seeks a criterion by which an off-diagonal element of the symmetric tri-diagonal matrix J may be deleted without changing any eigenvalue of J by more than E. The criterion obtained permits the deletion of elements of order square root of E under favorable circumstances, without requiring any prior knowledge about the separation between the eigenvalues of J. Author (TAB)

N67-11940# Cambridge Language Research Unit (England).
ESSENTIALLY FINITE CHAINS
J. C. Amson and A. F. Parker-Rhodes. 13 Sep. 1965. 14 p refs
(Contract AF-EOAR-78-65)
(AFOSR-66-0423; AD-637840) CFSTI: HC $1.00/MF $0.50

A sequence whose terms begin with a specific term (the originator) and whose subsequent terms are determined by a specific iteration procedure (the formulator) such that each inherits the structure of its processor, is called a chain. Examples are given to clarify the meaning of 'essentially.' The paper examines a number of instances in which an essentially infinite chain becomes essentially finite, and gives the necessary conditions on the dimensionality of the originator for the chains to be essentially finite and specifies the member at which the chain terminates. Where G is a group and F is the process of selecting any proper subgroup of G, the modification to F seems largely independent of the nature of G, except that G should have finite dimension, which permits explication in a setting of finite abelian groups and their endomorphisms. Author (TAB)

N67-11970# College of Aeronautics, Cranfield (England).
STABILITY OF PERIODIC SOLUTIONS OF A NONLINEAR DIFFERENTIAL EQUATION ARISING IN SERVOMECHANISM THEORY
P. A. T. Christopher. Apr. 1966. 20 p refs
(COA-AERO-191) CFSTI: HC $1.00/MF $0.50

The stability of the periodic solutions of a particular nonlinear differential equation of third order is discussed in terms of the asymptotic stability of the corresponding variational equation and, thereby, in terms of the characteristic exponents of this equation. A method is used to evaluate the characteristic exponents and thus the boundaries of asymptotic stability. Taking the solution to have, in the first approximation, an amplitude F and frequency ω, it is shown that one of the asymptotic stability boundaries corresponds to the locus of vertical tangents of the frequency response curves in the ω, F plane. This result is similar in character to, and a modest generalization of, the well known stability criterion associated with Duffing's equation. Author

N67-12075*# Pennsylvania State Univ., University Park.
ON THE CLASS OF ADMISSABLE NONLINEARITIES FOR LUR'E'S PROBLEM
Allan M. Krall. [1965] 5 p refs
(Grant NGR-39-009-041)
(NASA-CR-79765) CFSTI: HC $1.00/MF $0.50 CSCL 12A

The system N is mathematically defined, and conditions are imposed on the nonlinear function of the scalar, so that the system will be stable or asymptotically stable. The linear system L is also considered. L.E.W.

N67-12076*# Pennsylvania State Univ., University Park.
ROOT LOCUS ASYMPTOTES FOR THE SUM OF TWO POLYNOMIALS OF THE SAME DEGREE
Allan M. Krall. [1966] 8 p refs
(Grant NGR-39-009-041)
(NASA-CR-79764) CFSTI: HC $1.00/MF $0.50 CSCL 12A

The existing confusion concerning the asymptotes of the root locus diagram of the sum of two polynomials having the same degree is discussed, and the viewpoint is offered that the confusion arises because the root locus does not approach the asymptotes as the parameter approaches $\pm\infty$, but instead as it approaches -1. Theorems and proofs are presented to show that as the parameter approaches -1, the coefficient of the highest power of the polynomial approaches zero, and the polynomial is reduced in degree. An example is included. The point is made that asymptotes do exist when the parameter is real valued, and are important in constructing the root locus diagram. M.G.J.

N67-12158*# Wyle Labs., Inc., Huntsville, Ala.
SOME INTEGRATION FORMULAE WHICH SIMPLIFY THE EVALUATION OF CERTAIN INTEGRALS IN COMMON USE BY ENGINEERS
M. J. Crocker and R. W. White. Apr. 1966. 31 p refs
(Contract NAS8-5384)
(NASA-CR-80098; WR-66-24) CFSTI: HC $2.00/MF $0.50 CSCL 12A

A table of fifty-six integrals is given which are of great use to the average engineer. These integrals are of the mixed polynomial, exponential, and trigonometric type. Some of these integrals are already available in the standard tables of integrals, although they are usually given without phase constants included in the arguments. Use of this table of integrals reduces the amount of algebraic manipulation needed to evaluate many common integrals. Four integration formulas are also derived which show that the fifty-six integrals given here are rather special; and these formulas show how the integrals presented may be derived from the simpler integral tables, in which phase angles are neglected, by the process of induction. Author

N67-12170*# New York Univ., N. Y. Lab. for Electroscience Research.
DETERMINATION OF HIDDEN EDGES IN POLYHEDRAL FIGURES: CONVEX CASE
Philippe Loutrel. Sep. 1966. 33 p refs
(Grant NgR-33-016-038)
(NASA-CR-80131; TR-400-145) CFSTI: HC $2.00/MF $0.50 CSCL 12A

This report is concerned with the problem of determining the hidden lines of computer-drawn, convex polyhedra. This is the so-called "hidden-line problem," limited here to convex polyhedra. The solution presented should be considered as a step toward the eventual solution of the more general problem of non-convex polyhedra. Results based on actual computer tests are included. Author

N67-12188# RAND Corp., Santa Monica, Calif.
POWER OF THE F-TEST FOR NONNORMAL DISTRIBUTIONS AND UNEQUAL ERROR VARIANCES
T. S. Donaldson. Sep. 1966. 65 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-5072-PR; AD-639163) CFSTI: HC $3.00/MF $0.75

An empirical investigation was made of the power of the F-test when the underlying distribution is nonnormal and the within-cell variances are not homogeneous. It is shown that even for small samples the analysis-of-variance F-test is valid, although the usual assumptions of normal distribution and homogeneous error variances are seriously violated. The test is shown to be valid for both Type I and Type II error. An analysis of the correlation between the numerator and denominator of the null hypothesis F-ratio demonstrates that the distribution of F is little affected by the shape of the underlying distribution. Author (TAB)

N67-12194# Stanford Univ., Calif. Dept. of Statistics.
A CLASS OF NON-PARAMETRIC ESTIMATES OF A SMOOTH REGRESSION FUNCTION

Richard M. Royall 11 Aug. 1966 74 p refs
(Contract Nonr-225(53); Grant PHS-5T1-GM-25-09)
(TR-91; AD-639466) CFSTI: HC$3.00/MF$0.75

The purpose of the paper is to develop methods for estimating regression functions (i.e., conditional expectations) when nothing is known or assumed about their underlying functional form. The approach is 'non-parametric' in the sense that the regression function itself, rather than a set of numerical parameters, is estimated. The methods given make use of certain rank order statistics and thereby avoid problems of scaling which are troublesome when less sophisticated non-parametric methods are used. The large sample performance of the proposed regression estimators is studied in detail and methods for obtaining high orders of asymptotic efficiency are given. The asymptotic (normal) distribution of the estimates is obtained and the related problem of prediction is discussed. (Author) TAB

N67-12254*# Kent State Univ., Ohio. Dept. of Mathematics.
APPLICATION OF HASSE DIAGRAMS FOR COUNTING TOPOLOGIES ON FINITE SETS Technical Report No. 14
Richard W. Piotrowski Sep. 1966 40 p refs
(Grant NSG-568)
(NASA-CR-80103; TR-14) CFSTI: HC $2.00/MF $0.50 CSCL 12A

Hasse diagrams are used to find the number of all elements in the class of all topologies on A_n for the case where A_n is a set consisting of n elements. Counting the number of partial orders on A_n and on partitions of A_n was used to obtain the exact number of homeomorphic and non-homeomorphic topologies for $n \leq 5$ and partial results for $n=6$. This representation of all partial orders on a set by Hasse diagrams also leads to the determination of the number of T_0-topologies on A_n. It was also shown that the number of subsets in the $k+1^{st}$, $0<k<n-1$, largest topology for A_n is given by $(2^k+1)\,2^{n-k-1}$. G.G.

N67-12287# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
REDUCIBILITY OF MATRIX POLYNOMIALS AND THEIR TRACES
John S. Lew Apr. 1966 12 p refs
(Contract Nonr-562(40))
(TR-10; AD-635446) CFSTI: HC$1.00/MF$0.50

For nxx matrices, we show the reducibility in degree of certain products of matrix variables and their traces, thus generalizing from two- and three-dimensional space some results used by Rivlin, Smith, and Spencer to get an orthogonal integrity basis for second-rank symmetric tensors. In particular we show the reducibility for $n>3$ of any product of $2n-1$ matrices and of its trace. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N67-11261*# National Aeronautics and Space Administration, Washington, D. C.
SCIENTIFIC DEFINITION OF THE SATELLITE FR-2 PROJECT (PROJECT EOLE)
Pierre Moral Sep. 1966 46 p refs Transl. into ENGLISH from Centre Natl. de la Sci. Serv. d'Aeronomie (France), No. 101, May 1966
(NASA-TT-F-10297) CSCL 04B

Theoretical principles and preliminary experiments of the French Eole project are discussed to demonstrate the advantage of a dense constant-level balloon system, queried by the FR-2 satellite, for complete coverage of worldwide air-mass movements and accurate weather forecasting. Oceanic coverage by floating buoys, required density of balloon distribution, launching sequence, and optimum levels of flight are evaluated on a mathematical basis. Optimum expected horizontal and vertical resolutions for a global meteorological observation system are given as 1000x1000 km^2 and five levels of 100–800 mb, respectively. Real-time and stored computation of mean horizontal wind velocity, with allowance for errors due to altitude fluctuations, are discussed. Author

N67-11272# National Engineering Science Co., Pasadena, Calif.
ATMOSPHERIC WATER BUDGET OVER TROPICAL AREAS Final Report
W. H. Portig Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 102 p refs
(Contract DA-28-043-AMC-01549(E))
(ECOM-01549-F; AD-638757)

Different methods for investigating the water vapor budget over the Caribbean Sea and the Gulf of Mexico are discussed and relevant data sources are listed. From the beginning the study of actual data revealed that the diurnal variation of vapor transport was so large that observations obtained at one fixed hour (or two) daily were not representative for the entire day, and that averages of such data did not represent the average flow. The difference between 12Z and 00Z data is taken as an indication of the diurnal variation and is discussed in detail. The main result is that the diurnal variation is almost the same over large portions of the region irrespective of the geographic conditions near the individual stations, but that a network over the central Pacific Ocean does not show a definite diurnal variation comparable with that over the American waters. Local and spatial differences of the 12Z minus 00Z difference are described. The only data collection accessible to the author containing upper air observations at intervals shorter than twelve hours was analyzed. The result of the analysis shows that diurnal changes are of the same order of magnitude as the mean totals. Hence, trajectories (of water vapor, pollution, fallout, etc.) depend greatly on the time of the day. Author (TAB)

N67-11365*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
AN ATLAS OF STRATOSPHERIC MEAN ISOTHERMS DERIVED FROM TIROS VII OBSERVATIONS
James S. Kennedy Jul. 1966 85 p refs
(NASA-TM-X-55587; X-622-66-307) CFSTI: HC $2.50/MF $0.75 CSCL 04B

The TIROS VII meteorological satellite, launched 19 June 1963, was equipped with a medium resolution scanning radiometer. One of the spectral regions observed, the 15 micron region, largely measured the emission from the stratosphere. The spatial and temporal variations of the observed 15 micron emission were found to correspond closely to major thermal patterns of the stratosphere. The data have been compiled and mapped on a series of ten-day mean charts, normally at five-day intervals, covering the 13-month period subsequent to launch. The charts comprise data from regions of the globe normally inaccessible to conventional means and are presented as a guide to stratospheric behavior during the period of June 1963 to July 1964. Author

N67-11818*# Weather Bureau, Silver Spring, Md.
AN EXPERIMENT DESIGNED TO DETERMINE THE DIURNAL TEMPERATURE AND WIND VARIATION AND TO DETECT POSSIBLE ERRORS IN ROCKETSONDE TEMPERATURE MEASUREMENTS IN THE UPPER STRATOSPHERE

Frederick G. Finger and Harold M. Woolf Washington, NASA, Nov. 1966 22 p refs Sponsored by NASA
(NASA-TM-X-1298) CFSTI: HC$1.00/MF$0.50 CSCL 04B

HASP and ARCAS rockets, carrying WOX-1A and Arcasonde 1A instrumentation, respectively, were launched at Wallops Island during a 39-hr period in September 1965 to gain information regarding (1) the daily variation of temperature and wind within the 30- to 50-km layer, (2) possible solar radiational effects on rocketsonde temperature measurements, and (3) the compatibility between temperatures measured nearly simultaneously by the rocketsondes and by supporting balloon-borne radiosondes. Analysis of the observed rocketsonde temperatures indicates a diurnal variation ranging from about 3C at 30 km to 9C at 48 km. Marked differences in the temperatures measured by rocketsondes launched prior and subsequent to sunrise and sunset suggest that a portion of the variation may not be real, but is possibly a function of instrumental error. Temperatures obtained from several rockets launched within a short time interval disclose that the HASP (WOX-1A) system is capable of reproducing a given temperature profile with relatively small random error. In addition, ARCAS (Arcasonde 1A) measurements appear compatible with those of the HASP. Author

N67-11825# Joint Publications Research Service, Washington, D. C.
SNOW COVER AND A CALCULATION OF SNOW FLOODS IN FOREST AND STEPPE REGIONS
I. S. Grishin 7 Nov. 1966 16 p Transl. into ENGLISH from the book "Snezhnyy Pokrov i Raschet Snegovykh Pavodkov v Lesostepnoy i Zonakh" Moscow, Nauka p 107–128
(JPRS-38499; TT-66-34924) CFSTI: $1.00

Tables of supplementary data on snow cover are presented. Included are: average perennial reserve of water in snow cover; maximum reserve of water in the snow cover in field and ravine; duration of blizzards; maximum reserve of water in snow cover in forest and field; calculation of lake regulation; and calculation of maximum discharge of snow floods. N.E.N.

N67-11870# Finnish Meteorological Office, Helsinki.
OBSERVATIONS OF RADIOACTIVITY, 1965
Veikko A. Helminen and Rolf Mattsson 1 May 1966 66 p ref
(Rept.-5) CFSTI: HC$3.00/MF$0.75

Measurements of radioactivity in the air and rainwater are presented from various sampling localities throughout Finland. Fractions of aerosol beta activity that decay within 4 hours and those that remain three days after the end of the sampling period are listed. Beta activity measurements in precipitation and settled dust collected at Helsinki and Ivalo are also included. A.G.O.

N67-11927# Texas A&M Research Foundation, College Station. Dept. of Oceanography.
AUTOMATED ENVIRONMENTAL DATA COLLECTED OFF PANAMA CITY, FLORIDA Technical Report, Jun. 1962–Dec. 1964
A. Kirst, Jr. and C. W. Mc Math, Jr. May 1966 99 p refs
(Contract Nonr-2119(04))
(REF-66-9T; AD-637899) CFSTI: HC$3.00/MF$0.75

The report is a summary of the environmental air-sea data collected in the nearshore region off Panama City, Florida by an automated data acquisition system. The data were collected between June 1962 and December 1964. Various phases of the data acquisition, handling and reduction system are also discussed. Author (TAB)

N67-11934# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE MEASUREMENT OF TEMPERATURE IN THE STRATOSPHERE AND MESOSPHERE
Harold N. Ballard May 1966 48 p refs
(ECOM-5066; AD-639116) CFSTI: HC$2.00/MF$0.50

Careful consideration of the heat transfer equations for a rocket-borne stratospheric temperature sensor in the form of a spherical bead thermistor coupled with an experimental analysis of the physical, thermodynamic, and electrical characteristics of the rocketsonde, indicated that the corrections to the observed thermistor temperatures could be substantially reduced through development of a new rocketsonde. Redesign of the rocketsonde temperature sensor reduced the theoretical temperature correction at 65 km from a value of 36 C for the Delta-I temperature sensing instrument to approximately 5 C for the new design. Temperature data obtained with the new stratospheric temperature sonde STS-1 showed that, after instrument expulsion at 74-km and at rocket nose-cone temperature near 100 C, the thermistor temperatures at and below 60 km were, without correction, in close agreement with those predicted by the U. S. 1962 Standard Atmosphere Author (TAB)

N67-12037# Stanford Univ., Calif. School of Engineering.
SPINMAP: STANFORD PROPOSAL FOR AN INTERNATIONAL NETWORK FOR METEOROLOGICAL ANALYSES AND PREDICTION
Jun. 1966 415 p refs

The preliminary design of an international weather forecasting system is presented that takes full advantage of potentially available satellite and computer technology. The study defines what classes of weather prediction are beneficial to mankind, and estimates the value of such predictions. It defines and provides preliminary design for the systems believed most effective in sensing critical weather parameters and performing the short and long range forecasting calculations. A program to develop the system over the next ten years is defined, and the cost and benefits are analyzed. Finally, the international cooperation necessary for such an undertaking, including political and legal factors is discussed. Author

N67-12296# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
NIKE-APACHE STV (SR-027) (21 APRIL 1966) AND NIKE-APACHE STV (SR-028) (21 APRIL 1966) Meteorological Data Report
Lan E. Carter and Stan F. Kubinski May 1966 35 p
(DR-13; AD-633779) CFSTI: HC$2.00/MF$0.50

Meteorological data gathered for the launching of Nike-Apache STV (SR-027) and Nike-Apache STV (SR-028) are presented for the Ballistic Systems Division, U. S. Air Force, and for future ballistic studies. The meteorological data and resulting ballistic data appear in tabular form. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N67-12032*# TRW Systems, Redondo Beach, Calif.
EVALUATION OF A SEMI-ACTIVE GRAVITY GRADIENT SYSTEM. VOLUME I: TECHNICAL SUMMARY
P. C. Wheeler, R. G. Nishinaga, J. G. Zaremba, and H. L. Williams Washington, NASA, Nov. 1966 62 p refs
(Contract NAS5-9840)
(NASA-CR-593) CFSTI: HC$2.50/MF$0.75 CSCL 17G

This study is directed toward establishing the feasibility of utilizing a Semi-Active Gravity Gradient System (SAGS) for controlling the attitude of an earth-oriented spacecraft. The control

configuration employs an active reaction wheel for pitch attitude control. Roll/yaw control is achieved by operating the pitch wheel with a momentum bias, and by gimballing the wheel and coupling it to the vehicle through an energy removal mechanism to provide roll/yaw damping. The vehicle configuration assumed for this study is that of a scaled down (smaller and lighter) Nimbus. Implementation studies have resulted in two preliminary mechanical designs, both of which incorporate all mechanical functions required for attitude control. Indications are that a control system weight as low as 25 pounds (including signal processing and control electronics, but not the solar array control system or the inertia augmentation assembly) can be achieved, with a nominal power consumption of 14 watts. Author

N67-12050*# Marquardt Corp., Van Nuys, Calif.
THREE-AXIS PARAMETERIZATION STUDY. ADVANCED LIMIT CYCLE CONTROL TECHNIQUES FOR ATTITUDE CONTROL SYSTEMS Final Report, Jun. 29, 1965–Jun. 10, 1966
D. R. Slagle 10 Jun. 1966 175 p refs
(Contract NAS8-20018)
(NASA-CR-79498; S-545) CFSTI: HC $5.00/MF $1.00 CSCL 17G

Computer simulation techniques were used in a three-axis statistical study of proposed attitude control techniques, including simple box limit cycle, simple Diamond error limit cycle, and advanced limit cycles with velocity information and rate cutoff. Program tasks, i.e., analog computer simulation, digital computer program, automatic tolerance compensation investigation, and engine test data compilation, are discussed. It was concluded that an analog computer without the support of a large amount of digital logic equipment cannot perform with sufficient accuracy. The digital computer program, however, was felt to be useful in evaluating the four control techniques. The digital computer parameter studies indicated: (1) Engine thrust bias errors are important in all four control techniques, and in justifying the use of the advanced techniques. (2) Random errors in delivered impulse are also important in choosing a particular control technique. (3) A single engine with a loose thrust tolerance can have a great effect on fuel consumption. L.E.W.

N67-12098*# TRW Systems, Redondo Beach, Calif.
EVALUATION OF A SEMI-ACTIVE GRAVITY GRADIENT SYSTEM. VOLUME II: APPENDICES
P. C. Wheeler, R. G. Nishinaga, J. G. Zarembe, and H. L. Williams Washington, NASA, Oct. 1966 210 p refs
(Contract NAS5-9640)
(NASA-CR-594) CFSTI: HC $3.75/MF $1.25 CSCL 17G

In connection with studies of a gravity gradient satellite system, appendixes to its evaluation report are presented. Damping, roll–yaw acquisition, and pitch acquisition are studied for spacecraft altitude orientation following orbital injection. Reaction wheel control system design studies are outlined, and a disturbance torque analysis presented. Concluding data refer to implementation feasibility, and evaluation. R.U.

N67-12103*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRAPDOWN ELECTRICALLY SUSPENDED GYRO DEVELOPMENT
T. J. Donlin *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 15–16 ref (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Test data are summarized on the compatibility tests conducted on the strapdown electrically suspended gyro (ESG) and the rotor housing assembly, the suspension electronics, the readout electronics, and the control console. The modifications indicated by the results are discussed; these involved the use of three different frequencies, one on each axis, to detect rotor-to-electrode capacitance. It is pointed out that this means of detecting rotor position allows greater stability with regard to dimensional, temperature, and rotor electrical changes. M.G.J.

N67-12108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TITANIUM OXIDE THIN FILMS
J. Maserjian *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 20–21 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Consideration is given to a thin film detector or thermactor, which is defined as a thin film capacitor with a large temperature dependence. Changes in capacitance caused by a temperature rise due to incident radiation enables this device to be used as a detector of infrared radiation. It is pointed out that this temperature dependence was observed in Al–TiO_2–Al thin film structures, and is correctly predicted by theory, where it is shown to arise as a consequence of an effective barrier width in the oxide film which varies as a funtion of temperature. M.G.J.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N67-11326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC ANALYSIS OF RADIOISOTOPE THERMIONIC GENERATORS
James J. Ward and Larry S. Blair Washington, NASA, Nov. 1966 31 p refs
(NASA-TM-X-1312) CFSTI: HC $2.00/MF $0.50 CSCL 10A

A cylindrical heat-source geometry was assumed with thermionic diodes located either around the lateral surface of the fuel block or on the flat ends. Generator rather than overall power-system performance was analyzed; that is, such mission dependent considerations as nuclear shielding, reentry protection, and power conditioning were not included. The heat source was treated parametrically by using the effective-volume power density of the heat source as a variable. Generator efficiency and specific weight were determined for fuel-block length-to-diameter ratios from 0.5 to 10.0, effective-volume power densities from 0.5 to 10.0 watts per cubic centimeter (W/cc), thermionic diode emitter temperatures from 1600° to 2000°K, and generator electrical output powers from 100 to 1000 watts. The results generally indicate that for each configuration a performance advantage is gained by achieving fuel-block effective-volume power densities in the range 3.0 to 5.0 W/cc, a diode emitter temperature of approximately 1800°K, and an electrical output power of about 500 watts. Generator specific weights on the order of 100 pounds per electric kilowatt (lb/kW_e) and generator efficiencies greater than 10 percent were calculated at these operating conditions. Author

N67-11337*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CONTROL OF A NUCLEAR REACTOR USING HELIUM-3 GAS CONTROL ELEMENTS
H. W. Davison, C. A. Heath, and W. Lowen Washington, NASA, 1966 14 p Presented at the Am. Nucl. Soc. Winter Meeting, Pittsburgh, 30 Oct.–3 Nov. 1966
(NASA-TM-X-52256) CFSTI: HC $1.00/MF $0.50 CSCL 18I

The feasibility of a control system for a water-moderated reactor that uses a neutron absorbing gas is demonstrated. The

neutron absorbing gas, helium-3, is contained in a number of metal containers evenly distributed through the core. Criteria to be met by the gas are enumerated, and two specific design features are listed as permitting adequate containment in a space reactor system. One is that flow restriction orifices can be placed in the distribution line, such that all of the gas in the control elements must pass through an orifice before leaving the core. The second design feature involves maintaining the gas pressure in the control system below the moderator pressure. An analysis of the possible nuclear-thermal coupling within the gas system is also made. The major advantage of the system lies in the fact that the reactor control can be maintained without perturbing a desired power shape. The feasibility in terms of pressure ranges, operating temperatures, element sizes, and control worths is demonstrated. The system has a stable configuration under steady state conditions which is only slightly different in control worth from a constant density poison. S.P.

N67-11377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMIC TESTING OF SNAP III RADIOISOTOPE THERMOELECTRIC GENERATOR
Owen C. Kardatzke Aug. 1966 18 p refs
(NASA-TM-X-55603; X-716-66-374) CFSTI: HC $1.00/MF $0.50

A dynamic method of measuring the output power characteristics of a radioisotope thermoelectric generator (RTG) is reported. This method of measurement incorporates simulated operation of the RTG, reduces the time required to obtain I-V characteristic curves, and provides more complete I-V curves than static methods. The measurements were made using a modified SNAP III generator. Author

N67-11709# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MAY 1966
Donald L. Keller 1 Jun. 1966 26 p refs
(Contract W-7405-ENG-92)
(BMI-1774) CFSTI: HC $2.00/MF $0.50

Research progress is reported in sections on reactor materials and components, ceramic and cermet fuels, UN–PUN fuel materials, smoke photometer, and corrosion resistance of materials used in fluidized-bed fluoride-volatility processes for fuel recovery. NSA

N67-11710# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING APRIL 1966
Donald L. Keller 1 May 1966 33 p refs
(Contract W-7405-ENG-92)
(BMI-1771) CFSTI: HC $2.00/MF $0.50

Research progress is reported in sections on reactor materials and components, ceramic and cermet fuels, UN–PUN fuel materials, portable smoke photometer, coated particle fuel materials, and corrosion resistance of construction materials used in fluidized-bed fluoride-volatility processes for fuel recovery. NSA

N67-11712# Atomics International, Canoga Park, Calif.
ERRORS IN MEASUREMENTS OF BUILDING LEAKAGE DUE TO DYNAMIC TEMPERATURE EFFECTS
C. T. Nelson, M. A. Greenfield, and R. L. Koontz 1 Aug. 1966 19 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-12001) CFSTI: HC $1.00/MF $0.50

A reference vessel method was used to analyze sources of errors in determining leakage rates of a containment structure. It was shown that the most serious errors do not arise from lack of precision in measuring absolute temperatures and pressures; rather, the largest errors were shown to be due to a combination of a temperature lag between reference vessel and containment structure, and from temperature fluctuations during the testing period. Author (NSA)

N67-11719# Atomics International, Canoga Park, Calif.
A DIGITAL COMPUTER STUDY OF THE DYNAMICS OF THE COMBINED ROTATING UNIT SHAFT-BEARING SYSTEM
J. M. Howard 15 Jul. 1966 38 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11944) CFSTI: HC $2.00/MF $0.50

The objectives, method of approach, and results of a digital computer rotordynamic analysis of the SNAP 2 Combined Rotating Unit-V are summarized. Bearing characteristics are in the form of curve fit equations based on empirical data. The effects of shaft bending, differences in fabrication and balancing tolerances, and varying orientation of the rotating magnetic load are evaluated. Author (NSA)

N67-11744# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
U-238 RESONANCE SHIELDING OF EPICADMIUM REACTIONS IN U-235, Pu-239 AND Mn-55 DETECTORS
D. H. Carter and J. E. Sanders Mar. 1966 29 p refs
(AEEW-R-483)

Experiments have been made to measure the shielding effect of U-238 resonances on epicadmium fissions in U-235 and Pu-239 and on epicadmium activations of Mn-55. The experimental method is based on the comparison of detector reaction rates in cadmium-covered rods of depleted uranium and lead/U-238 placed in the centre channel of a subcritical assembly. The measured shielding factors have been compared with the predictions of a simple theoretical model and reasonably good agreement is obtained. Author

N67-11748# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
THE AECL STUDY FOR AN INTENSE NEUTRON-GENERATOR Technical Details
G. A. Bartholomew and P. R. Tunnicliffe, ed. Jul. 1966 698 p refs Available from Atomic Energy of Canada, Ltd., Chalk River: HC $10.00; CFSTI: $3.00
(AECL-2600)

A detailed description is presented for the construction of the intense neutron-generator (ING). Discussions encompass plant facilities, the construction schedule, estimated costs, the reference design accelerator, and the beam-transport system. Construction is envisaged in two stages: the basic machine providing minimum experimental facilities, and the full machine consisting of the completed design. Competitive systems are considered as well as applications of the ING. S.P.

N67-11758# India. Dept. of Atomic Energy, Bombay.
FUEL CYCLES IN PHWR AND CANDU TYPE REACTORS
B. P. Rastogi, H. K. Bhatia, A. N. Nakra, K. R. Srinivasan, and T. A. Subramanian 1966 32 p refs Presented at the Symp. on Thorium Fuel Cycles, Gatlinburg, Tenn., 3–6 May 1966
(AEET-252) CFSTI: HC $2.00/MF $0.50

The heavy water moderated reactors, both of pressure vessel design and pressure tube design, are being studied. The pressure vessel reactor of PHWR type uses a hot moderator but no pressure tubes. The pressure tube reactor is of the Candu type using cold moderator and bidirectional fueling. Some physics aspects of thorium utilization in these reactors are discussed. Author

N67-11819*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL FISSION-ELECTRIC CELL EXPERIMENT
W. F. Krieve 15 Nov. 1966 24 p refs
(Contract NAS7-100)
(NASA-CR-79040; JPL-TR-32-981) CFSTI: HC $1.00/MF $0.50
CSCL 18E

A series of experiments was performed with two different large concentric cylinder fission-electric cells in thermal neutron fluxes up to $10^{10} n/cm^2 sec$ in a nuclear test reactor. A clearcut demonstration of the fission-electric cell concept was achieved. Fission fragment currents up to 10^{-8} amp, which were in good agreement with calculated values, were observed. Magnetic field suppression of electron counter-currents was completely successful. Electrostatic grid suppression of the extraneous electrons was much less effective. The original cell configuration, in which the anode cylinder surrounded the inner cathode cylinder, achieved stable potentials of approximately one kilovolt. The modified configuration, in which the cathode with electron sweep rings surrounded the anode, reached potentials as great as 21 kv, but was not stable above 4 kv. Author

N67-11875# Aktiebolaget Atomenergi, Stockholm (Sweden).
PHYSICS EXPERIMENTS AT THE AGESTA POWER STATION
G. Apelqvist, P.-A. Blixelius, P. E. Blomberg, E. Jonsson, and F. Akerhielm Sep. 1966 32 p refs
(AE-244) CFSTI: HC $2.00/MF $0.50

Dynamic measurements were performed at reactor power levels from 0.3 to 65 MW (th). The experiments were conducted to develop methods and equipment for dynamic studies and to measure the dynamic characteristics of the reactor in order to check the dynamic model. The experiments were performed with four different perturbation functions: trapezoidal and step functions, and two types of periodic multifrequency signals. Perturbations were introduced in the reactivity and in the load. Recordings were made of the responses of nuclear power, coolant inlet, and outlet temperature and control rod position. The results are presented as step responses and transfer functions (Bode diagrams). Static measurements of the physics parameters were conducted to confirm theoretical methods of reactor calculations and to form a basis for safe operation of the reactor. The temperature coefficient of the moderator was measured by lowering the moderator temperature at constant power and observing the change in control rod insertion. The radial power distribution was found from the coolant temperature rise in the individual fuel channels and from an out-of-pile γ-scanning of representative fuel elements. C.T.C.

N67-11902# India. Dept. of Atomic Energy, Bombay.
PHYSICS STUDIES OF PROTOTYPE POWER REACTOR PROJECT
B. P. Rastogi, K. R. Srinivasan, A. N. Nakra, H. K. Bhatia, H. C. Hurie et al 1965 73 p refs
(AEET-239) CFSTI: HC $3.00/MF $0.75

A prototype power reactor is discussed which is a heavy water moderated plutonium enriched reactor whose core contains 55 vertical channels. The central 37 channels are cooled by D_2O and use a CANDU-type fuel; the outer 18 channels are considered available for the development of various coolants and fuel elements. Details are included for the core design, including some calculations for a 91-channel core. Reactivity worth of the central fuel rod is discussed, along with variation of flux with time on additon of small positive reactivity, long-term reactivity changes, temperature coefficient of reactivity for hot and clean calculations, and safety and control aspects. Attention is also given to the cold and hot lattice parameters, and graphs and tables present data for three lattice pitches and four enrichments of plutonium in uranium. M.W.R.

N67-11903# Aktiebolaget Atomenergi, Stockholm (Sweden).
BURN-UP DETERMINATION BY HIGH RESOLUTION GAMMA SPECTROMETRY: SPECTRA FROM SLIGHTLY-IRRADIATED URANIUM AND PLUTONIUM BETWEEN 400–830 KEV
R. S. Forsyth and N. Ronqvist Aug. 1966 23 p refs
(AE-241) CFSTI: HC $1.00/MF $0.50

Fission product spectra are presented of irradiated uranium and plutonium obtained by means of a lithium-drifted germanium detector. The resolved gamma peaks have been assigned to various fission products by correlation of measured energy and half-life values with published data. By simultaneous study of the spectra of two irradiated mixtures of plutonium and uranium, the possibility of using the activities of Ru-103 and Ru-106 as a measure of the relative fission rate in U-235 and Pu-239 is examined. Author

N67-11904# Aktiebolaget Atomenergi, Stockholm (Sweden).
INTERCRYSTALLINE STRESS CORROSION CRACKING OF INCONEL 600 INSPECTION TUBES IN THE AGESTA REACTOR
B. Groenwall, L. Ljungberg, W. Huebner, and W. Stuart Aug. 1966 26 p refs
(AE-245) CFSTI: HC $2.00/MF $0.50

Intercrystalline stress corrosion cracking has been observed in three so-called inspection tubes of Inconel 600 in the Ågesta reactor. The cracks developed on the outside surface of the tubes, which were exposed to 217°C light water containing normally 1 to 4 ppm LiOH or KOH and small amounts of oxygen and chloride. These elements may have enriched in the crevices at which most of the cracking occurred. Other factors which are thought to have contributed to the cracking are tensile stresses of the order of the 0.2% offset yield strength built up during shop welding, and a relatively high carbon content of the alloy (0.08%) giving rise to heavy precipitation of carbides inside and between the grains. The tube material had an unusually high yield strength. Irradiation and surface contamination were found to be of no importance. Author

N67-11905# European Atomic Energy Community, Brussels (Belgium).
KNOCK-OUT COEFFICIENT OF SINTERED URANIUM DIOXIDE
O. Gautsch and C. Mustacchi Aug. 1966 17 p refs
(EUR-3058.e) CFSTI: HC $1.00/MF $0.50

Sintered UO_2 wafers, facing a metal collector were irradiated at thermal neutron doses of about $5.10^{18} n/cm^2$. Quantitative analysis of the U deposits on the collector yielded a knock-out coefficient of 260 atoms (U+O) per average recoil fragment. Author

N67-11906# Gesellschaft fur Kernenergieverwertung Hamburg (West Germany).
NUCLEAR RESEARCH SHIP "OTTO HAHN" Annual Report, for 1965
Brussels, EURATOM, Aug. 1966 103 p refs In GERMAN; ENGLISH summary
(EURATOM-009-64-7-PNID)
(EUR-3066.d) CFSTI: HC $4.00/MF $0.75

Results are presented relative to the construction of a nuclear-powered research ship, and planning for future developments and improvements on the vessel is reviewed. The ship and its conventional plant, as well as progress related to the nuclear reactor power plant, are detailed; and numerous photographs illustrate various aspects of the nuclear research ship program. Transl. by M.W.R.

N67-11972# Societa Ricerche Impianti Nucleari, Saluggia (Italy).
FORCED CONVECTION BURNOUT AND HYDRODYNAMIC INSTABILITY EXPERIMENTS FOR WATER AT HIGH PRESSURE. PART II: PRESENTATION OF DATA FOR WATER FLOWING UPWARD ALONG A UNIFORMLY HEATED ROD IN A SQUARE UNHEATED DUCT

A. Campanile, G. Galimi, and M. Goffi Brussels, EURATOM, Aug. 1966 29 p Prepared with FIAT, Turin
(Contract EURATOM-008-61-12 PNII)
(EUR-2963.e) CFSTI: HC $2.00/MF $0.50

The N. 110 burnout data for water flowing upward, in conditions of forced convection at high pressure, in a vertical square annular channel were taken over a wide range of mass flow rate, inlet subcooling, and pressure. The data refer to a configuration of the cross section geometry in which a heater rod is centered in a square unheated channel. Only two data could be taken with eccentric transverse position of the rod in the flow channel before physical destruction of the heater. Author

N67-11977# Kernforschungsanlage, Juelich (West Germany).
BURNUP MEASUREMENT ON SPHERICAL FUEL-ELEMENTS BY MEANS OF A HIGH-RESOLUTION SEMI-CONDUCTOR-GAMMA SPECTROMETER [DIE MESSUNG DES ABBRANDZUSTANDES KUGEL-FOERMIGER BRENNELEMENTE MIT HILFE EINES HOCH-AUFLOESENDEN HALBLEITER-GAMMASPEKTROMETERS]
H. Bueker Brussels, EURATOM, Aug. 1966 39 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-003-63-1 RGAD)
(THTR-8; EUR-3071.d) CFSTI: HC $2.00/MF $0.50

A description is given of a method of measuring the burnup level of spherical fuel elements. A nondestructive and rapid burnup determination is obtained by means of gamma-spectrometry. The measuring apparatus is a high-resolution photo-peak gamma-spectrometer equipped with a lithium-drifted germanium semiconductor-detector. The Cs-137 photo-line at 662 keV serves as a reference-line for measurement. Its intensity provides a measurement of the burnup. The first measurements were carried out on a fuel sample. Further data obtained on fuel samples with various degrees of burnup, and an exact description of the burnup measurement rig constructed, will shortly be published. Author

N67-11989# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
FISSION PRODUCT CHAINS AND THEIR IMPORTANCE ON HIGH BURN-UP FUEL CYCLES
J. J. Devos and L. Massimo Aug. 1966 47 p refs
(EUR-3119.e) CFSTI: HC $2.00/MF $0.50

The inaccuracies introduced by errors in the fission yields and by simplifications of the fission product chains are assessed, and the effect of neglecting minor fission product chains and of grouping some of the fission products into aggregates is discussed. Author

N67-12011# Joint Publications Research Service, Washington, D. C.
COOLANTS FOR NUCLEAR POWER ENGINEERING INSTALLATIONS
Sergey Arkhipovich Ulybin 21 Nov. 1966 307 p refs Transl. into ENGLISH of the book "Teplonositeli Energeticheskikh Yadernykh Ustanovok" Moscow, Energiya, 1966 p 2–272
(JPRS-38717; TT-66-35141) CFSTI: $7.00

A book on the operational characteristics of coolants for use in nuclear power reactors is reported. Presented are data on the effects of radiation on the properties of coolants and structural material corrosion; methods for calculating coolant radioactivity; thermophysical, corrosive, and physicochemical properties of water, organic, liquid metal, and gas coolants used in nuclear power engineering; and characteristics of construction and operation of reactors as determined by the use of different coolants. S.C.W.

N67-12087# Joint Publications Research Service, Washington, D. C.
EXPERIMENTAL STUDY OF REACTOR ENERGY RELEASE BY NONUNIFORM FUEL REDISTRIBUTION
Ye. S. Glushkov and N. N. Ponomarev-Stepnoy 28 Nov. 1966 7 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 20, no. 6, Jun. 1966 p 478–482
(JPRS-38833; TT-66-35257) CFSTI: $1.00

Questions of shaping of the heat rate were studied on critical assemblies with a beryllium oxide moderator and enriched uranium fuel. The assemblies featured nonuniform distribution of uranium, assuring the required distribution of heat rate per unit of volume of the active zone and a uniform distribution of the heat rate per unit of mass of the fissionable material. The experimental values of distributions of neutron streams, of the heat rate, and of the magnitude of the effective multiplication factor are in satisfactory agreement with calculated data obtained by numerical solution of multi-group equations on an electronic computer. Author

N67-12181# Oak Ridge National Lab., Tenn.
RESULTS OF THE ANALYSIS BY MONTE CARLO OF FAST-NEUTRON SHIELDING PROPERTIES OF COMPOUND CUBICAL AND SPHERICAL SHIELDS
F. H. Clark and N. A. Betz Sep. 1966 19 p refs
(Contract W-7405-ENG-26)
(ORNL-4009; AD-639572) CFSTI: HC $3.00/MF $0.75

An extensive program of calculations was performed to check certain fast-neutron dose-rate measurements made at Project BREN in 1962. The response characteristic of the modified long counter was computed. Nitrogen and oxygen cross sections were reviewed and used in calculations of the transport in air of neutrons from a Godiva source to a distance of 66 g/sq cm. Transport results obtained by Monte Carlo were compared with those obtained by the moments method. A spectrum at an 80-g/sq cm penetration was determined. The perturbating effect of a structure on the neutron field in its neighborhood was estimated. The effect of variations of the spectrum with penetration distances on doses computed with different weight functions was also examined; the Snyder-Neufeld multicollision physical dose was found to vary with distance in a way markedly different from others examined. Work was also done on importance sampling techniques, especially the exponential transform, and the sampling problem was formulated in a simplified, approximate expression to facilitate statistical interpretations. Finally, a number of shield penetration calculations were performed to compare with the measurements and to determine the effects of shield shape, shield cavity size, and source angular distributions incident on the shields. The agreement between the calculations and the measurements was within the uncertainty in the detector response characteristic Author (TAB)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N67-11257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL METHODS OF SOLVING DIFFERENTIAL AND INTEGRAL EQUATIONS AND QUADRATURE FORMULAS [CHISLENNYYE METODY RESHENIYA DIFFERENTSIAL'NYKH I INTEGRAL'NYKH URAVNENIY I KVADRATURNYYE FORMULY] Selected Articles

31 May 1966 63 p refs Transl. into ENGLISH of the book "Vychislitel'naya Matematika i Matematicheskaya Fizika" Moscow, Izd. Nauka, 1964 p 255–274, 304–325
(FTD-TT-65-1655; TT-66-62349; AD-639487) CFSTI: HC $3.00/MF $0.75

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1. DIFFRACTION OF THE FIELD OF A HORIZONTAL MAGNETIC DIPOLE ON TWO DISCS Ye. A. Ivanov p 1–12 refs (See N67-11258 02-23)

2. DIFFRACTION OF ELECTROMAGNETIC WAVES ON TWO PARALLEL DISCS Ye. A. Ivanov p 13–26 refs (See N67-11259 02-23)

3. NUMERICAL CALCULATION OF TWO-DIMENSIONAL FLOW IN A BOUNDARY LAYER I. V. Petukhov p 27–55 refs (See N67-11260 02-12)

N67-11258# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFRACTION OF THE FIELD OF A HORIZONTAL MAGNETIC DIPOLE ON TWO DISCS
Ye. A. Ivanov *In its* Numerical Methods of Solving Differential and Integral Equations and Quadrature Formulas 31 May 1966 p 1–12 refs (See N67-11257 02-23) CFSTI: HC $3.00/MF $0.75

A solution is given to the problem of the diffraction of the field of an elementary magnetic dipole on two parallel infinitely thin ideally conducting discs with a common axis of rotation when the dipole is located on the surface of one of the discs. The solution is found in the form of series in elementary wave functions of a flattened spheroid whose coefficients satisfy an infinite system of linear equations which is solved by the method of truncation. R.N.A.

N67-11259# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIFFRACTION OF ELECTROMAGNETIC WAVES ON TWO PARALLEL DISCS
Ye. A. Ivanov *In its* Numerical Methods of Solving Differential and Integral Equations and Quadrature Formulas 31 May 1966 p 13–26 refs (See N67-11257 02-23) CFSTI: HC $3.00/MF $0.75

A continuation is presented to the problem of the diffraction of the field of an elementary magnetic dipole on two parallel infinitely thin and ideally conducting discs of radius a with a common axis of rotation located at a distance 1 from each other in a vacuum when the moment of the dipole is parallel to the surfaces of the discs. Here the problem involves the diffraction of a field of radiation of a disc with a unilateral elementary crack on one of the discs. A solution is found in the form of series in elementary wave functions of a flattened spheroid whose coefficients satisfy an infinite system of linear equations which is solved by the method of truncation after changing $x_n^{(s)}$ and $y_n^{(s)}$ to the new coefficients $X_n^{(s)}$ and $\overline{Y}_n^{(s)}$ according to certain formulas if 1 is greater than a. These formulas are used to obtain numerical results for all those values of the parameter $c = ka(1 > 2a)$ that are convenient for the same crack and in the problem on the diffraction of the field of a dipole on one disc. New formulas are established for $X_n^{(s)}$ and $\overline{Y}_n^{(s)}$ in closed form that are more convenient for numerical calculation and the study of the diffraction fields for some particular values of the parameters $c_0 = kl$ and $c = ka$. R.N.A.

N67-11299# Naval Research Lab., Washington, D. C.
THE MAGNETIC TORQUE OF IDEAL SUPERCONDUCTING TOROIDS Final Report
E. E. King 9 Aug. 1966 7 p refs
(NRL-6414; AD-638802) CFSTI: HC $1.00/MF $0.50

Torsional experiments were performed at this laboratory with superconducting toroids. In order to discuss the results, knowledge of the expected behavior of an ideal superconducting toroid is needed. Equations which describe this ideal behavior were found in terms of three geometrically dependent constants, namely, the proportionality constants between components of the applied magnetic field and components of the magnetic moment of the toroid resulting from flux expulsion and any net current. Calculations of these three constants are available for toroids of circular cross sections from other NRL Reports. It is possible to estimate values for other than circular cross sections. Author (TAB)

N67-11324*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE CRYOGENIC GYROSCOPE PROGRAM AT JET PROPULSION LABORATORY Final Report
John T. Harding 1 Jul. 1966 29 p refs
(Contract NAS7-100)
(NASA-CR-79872; JPL-TR-32-897) CFSTI: HC $2.00/MF $0.50 CSCL 20M

A technical account of the development of the superconducting gyroscope is presented. The program, which began with levitating a superconducting ball with a single coil, has advanced to the point where total drift as low as one degree per day has been obtained with a research model of the gyro. The principal problems encountered in the program are namely: rotor fabrication, alternating magnetic field losses in superconductors, magnetic field configuration required for levitation, damping of rotor oscillation, refrigeration, spinup, and readout. Author

N67-11360*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIMP OPTICAL ASPECT COVERAGE—THREE DIMENSIONAL APPROXIMATION
F. R. Chromey Jun. 1966 21 p refs
(NASA-TM-X-55578; X-507-66-256) CFSTI: HC $1.00/MF $0.50 CSCL 20F

This study derives an approximate method for determining the duration of coverage of the sunlit earth by the anchored IMP (AIMP) optical aspect system. The derivation is designed so that coverage data may be obtained through minor modifications of an existing computer program (QUIMP). Results are applicable to any spin-stabilized vehicle with a similar optical aspect system. Plots of the aspect system coverage for several AIMP launches are included. Author

N67-11368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION OF AN OPTICAL ASPECT SYSTEM
Charles R. Newman and Manuel Lerman Mar. 1966 20 p ref
(NASA-TM-X-55588; X-507-66-309) CFSTI: HC $1.00/MF $0.50 CSCL 20F

A method is described to calculate the angle through which a telescope mounted on a spinning spacecraft "sees" the sunlit portion of a specified central body. The body is assumed to be a sphere and the spacecraft is assumed to make a full revolution at the given time. The equations of the terminator plane (the plane separating the sunlit and dark portions of the central body) and the tangent plane (the plane separating the portions of the central body that are visible and nonvisible from the spacecraft) are derived. Author

N67-11703# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FUNDAMENTALS OF STATISTICAL ENERGY ANALYSIS OF VIBRATING SYSTEMS Final Report, Jul. 1965–Feb. 1966
Eric E. Ungar Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., May 1966 75 p refs
(Contract AF 33(615)-2649)
(BBN-1350; AFFDL-TR-66-52; AD-637504) CFSTI: HC $3.00/MF $0.75

The concepts and relations which form the theoretical foundation of the statistical energy approach to vibration analysis are delineated. The utility of this approach for dealing with complex systems is discussed, and its range of applicability is indicated. The important properties of the modes of vibrating systems are reviewed and used to exhibit relations between modal responses and average responses of total systems. It is demonstrated that under some conditions, which are often approximated in actual systems, the average rate of flow of energy from one mode to another is proportional to the difference in the modal energies. It is also shown that under some conditions the average rate of flow of energy between two sets of modes (representing groups of modes of two coupled systems in a given frequency band) is proportional to the difference in the set-average modal energies. Examples are presented which indicate how these relations permit one to obtain approximate solutions to complex problems simply, on the basis of energy conservation considerations. Available extensions of the major concepts developed in detail are mentioned, and references to the current literature are given. Author (TAB)

N67-11828# Joint Publications Research Service, Washington, D. C.
PRACTICAL APPLICATION OF LIQUID CRYSTALS
Yelena Knorre 9 Nov. 1966 5 p Transl. into ENGLISH from Zarya Vostoka (Tbilisi), 8 Sep. 1966 p 4
(JPRS-38573; TT-66-34998) CFSTI: $1.00

A narrative account is given of liquid crystals, their discovery, and their properties. It is reported that most of the known crystals are organic compounds, that they flow like water but have an ordered structure. The characteristics of cholesterol, including its optical properties, are described briefly as an illustration. N.E.N.

N67-12040# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
PROPERTIES OF LIQUID HYDROGEN
Robert J. Corruccini [1965] 54 p refs Presented at the Short Course on Liquid Hydrogen Technol., Grenoble, France, 8 Jun. 1965

A survey is presented of the available knowledge of those physical properties of liquid hydrogen that are of technological importance. Some of the physics that explained the special characteristics of hydrogen are given, including the effects of quantum diffraction, nuclear spin, and symmetry. A catalog of the major sources of data and extracts of these data is included. Some special topics that have not been dealt with adequately in previous surveys are discussed and include surface tension, infrared absorption, index of refraction, and thermoconductivity. R.N.A.

N67-12082*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ESTIMATES OF THE STATISTICS OF RANDOMLY VARYING PARAMETERS OF LINEAR SYSTEMS
S. M. Brainin and G. A. Bekey Jun. 1966 29 p refs
(Grant NGR-05-018-022)
(NASA-CR-79759; USCEE-171) CFSTI: HC $2.00/MF $0.50 CSCL 09C

A technique, based on the Fokker-Planck equation, is developed for estimating the statistics of randomly varying parameters in systems whose differential equation is known a priori. The resulting mathematical model then applies to a family of similar systems rather than to an individual. The Fokker-Planck equation is applied to a first order linear system with a random (Gaussian) parameter. First order differential equations for the moments of the system output are generated and used to estimate the first and second moments of the random parameters. The identification procedure is based on regression techniques. The results of an application of the technique to a specific first order system are presented with a theoretical discussion of the accuracy of the identification procedure. The concluding section of the paper discusses the extension of the techniques to higher order linear and non-linear systems. Author

N67-12171*# North Carolina State Coll., Raleigh.
COMPENSATION OF THE EFFECTS OF THE SLOT IN A RECTANGULAR WAVEGUIDE
F. J. Tischer Oct. 1966 21 p refs
(Grant NGR-34-002-047)
(NASA-CR-80130; EML-RR-1) CFSTI: HC $1.00/MF $0.50 CSCL 20N

A method of compensating the effects of a slot in a rectangular waveguide on the propagation properties of the TE_{10} wave mode has been developed. The compensation consists of an extension of the side walls of the slot into the interior of the waveguide. The extended walls form ridges which deform the field configuration in the waveguide in such a manner that the impedance and propagation properties of the waveguide approach those of the non-slotted guide. The cross-sectional field configuration of the compensated-slot structure is evaluated by conformal mapping using a TEM-wave approach and the transformation function derived. Compensation criteria are derived which lead to relationships between the dimensions of the compensation ridges and the slot width of the rectangular guide for specific cross-sectional ratios a/b. As an example, the compensation of X-band waveguides is treated numerically. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N67-11363*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NEUTRON CAPTURE REACTIONS AND STELLAR NUCLEOSYNTHESIS
John H. Gibbons 20 Oct. 1966 30 p ref
(NASA-TM-X-53527) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The development of techniques for solving the problem of heavy element buildup is reviewed. Notable advances in the past leading up to the present technology are summarized, and modern methods are discussed and explained. The s-process hypothesis is presented and confirmed by accurate determination of the neutron capture cross sections and their correlation with isotopic abundance. The deduction of the r-process abundance, which involves neutron capture and beta decay by neutron-rich nuclides far from the valley of beta stability is presented, and the various lines of evidence for the r-process are outlined. Future projects in this field are also delineated. I.E.W.

N67-11356*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITRON ANNIHILATION IN HELIUM
Richard J. Drachman May 1966 22 p refs
(NASA-TM-X-55574; X-641-66-204) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The modified adiabatic scattering function previously used to compute phase shifts for positron-helium scattering below the positronium threshold is applied to the problem of annihilation in helium. A large enhancement factor relative to the Dirac rate is

found, varying with energy from 2.30 to 3.16. The probability of finding the spectator electron in states of the He+ ion other than the ground state is computed and found to be small but probably observable. Author

N67-11359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIOACTIVE NUCLEI PRODUCTION FROM RELATIVELY ABUNDANT NATURAL ELEMENTS
Robert J. Janda Jul. 1966 14 p
(NASA-TM-X-55577; X-716-66-248) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Tables are given as a guideline in evaluating potential radioactive nuclei production that could affect experiments or personnel in an accelerator laboratory. The elements included in the table were selected based on the following criteria: theoretical reaction threshold energies less than 17.0 MeV, half-life time greater than 0.2 sec, and natural element abundance greater than 1%. The table is intended to serve accelerator personnel by estimating half-life for materials placed within the accelerator beam, taking into account beam energy and particle type in determining whether the reaction goes to completion. It is pointed out that the table indicates only whether a potential reaction exists, and not necessarily that the reaction constitutes a radiological hazard. An example is given of using the table in evaluating the relative hazard of a proton beam on an aluminum target. L.E.W.

N67-11367*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXCITATION OF HYDROGEN MOLECULES BY ELECTRON IMPACT. II: EXCITATION TO D($3p\pi\ ^1\Pi_u$) STATE
S. P. Khare Jul. 1966 9 p refs
(NASA-TM-X-55589; X-640-66-312) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The investigation of the excitation of the hydrogen molecule by electron impact, employing one-center wave functions and Born and Born-Ochkur approximations, has been extended to the D($3p\pi\ ^1\Pi_u$) excited state (the excitation to the B and C states of the hydrogen molecule has been recently investigated by the author elsewhere). The oscillator strength is in excellent agreement with the experimental value of Geiger and with the theoretical value of Mulliken and Rieke. However, the generalized oscillator strengths are larger for $K < 0.33$ and smaller for higher values of K than those obtained by Roecoe. The total excitation cross sections are in fair accord with the estimates of Craggs and Massey. Author

N67-11742# European Organization for Nuclear Research, Geneva (Switzerland). Intersecting Storage Rings Div.
INDUCED 24Na ACTIVITY IN THE CONCRETE SHIELDING OF HIGH-ENERGY ACCELERATORS
D. Nachtigall and S. Charalambus 16 Sep. 1966 71 p refs
(CERN-66-28)

^{24}Na induced activity in the concrete shielding of high-energy accelerators is studied. It is found that besides 24Na produced by thermal neutron capture in 23Na, a significant amount of 24Na is produced by spallation processes from high-energy particles in other constituents of the concrete. By adding 0.3% boron to reduce the thermal neutron flux, the dose rate at the surface of concrete due to 24Na is reduced only by a factor 3; this factor depends on the 23Na content of the concrete. Figures are presented which give the production of 24Na at different depths in the concrete and the attenuation length in the concrete for fast particles and thermal neutrons producing the 24Na. Production of other important induced radio-nuclides in high-energy accelerators is considered, and comparisons are made for the dose rates coming from 24Na and from these other radionuclides. Author

N67-11752# Aktiebolaget Atomenergi, Stockholm (Sweden).
HALF LIFE MEASUREMENTS IN 155Gd
Sven G. Malmskog Aug. 1966 11 p refs
(AE-242) CFSTI: HC $1.00/MF $0.50

There exists a definite difference for the half life of the 86.5 keV level in ^{155}Gd depending on whether ^{155}Eu or ^{155}Tb sources have been used. Using a good energy resolution electron-electron coincidence spectrometer and a ^{155}Eu source, a half life of 6.48 ± 0.26 nsec was obtained for the 86.5 keV level. This is in agreement with the values previously measured with ^{155}Tb sources. The half life of the 105.4 keV level was measured to be 1.12 ± 0.05 nsec. Author

N67-11760# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PHOTOPRODUCTION OF NEUTRAL PIONS AT 500÷800 MeV. SEARCH FOR A "RESONANT" P_{11} AND π CUSP EFFECT
C. Bacci, G. Penso, G. Salvini (Rome Univ.), C. Mencuccini, A. Reale et al 25 Jul. 1966 11 p refs *Its* Nota Interna No. 330
(LNF-66/37) CFSTI: HC $1.00/MF $0.50

Results obtained with an electron synchrotron for the photoproduction of neutral pions at 500÷800 MeV are presented. The main characteristics of this experiment with respect to similar ones are better statistics and higher energy resolution. Measurements are intended to collect data with a p-γ coincidence method on the differential cross section at 120°, 135° in an energy region where the experimental data is lacking. Another purpose of the measurements is to look for the presence of any bump or enhancement in the photoproduction cross section due to the new isobaric state P_{11}, and to get evidence for a fine structure in the region of the second resonance. S.P.

N67-11867# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
A BUILD-UP CORRECTED SINGLE COLLISION MODEL FOR GAMMA RAY BACKSCATTERING
Walter Lowen Jun. 1963 70 p refs
(EIR-53) CFSTI: HC $3.00/MF $0.75

A build-up corrected single collision Kernal is developed to calculate the backscattered energy flux at a specified location resulting from a monoenergetic point monodirectional gamma beam incident with a given angle of incidence on a scatterer of specified thickness. The formulation is supported by phenomenological analysis and by a comparison of total energy albedos, as calculated by a single collision Kernal, to Monte Carlo data. A scattering factor, derived from the build-up corrected Kernel was evaluated for 1 Mev gammas incident on concrete by means of a computer program for the IBM 709. Application of the scattering factor to the solution of reflection problems in realistic geometry is illustrated by a sample problem. Extended applications to slant incidence transmission problems are indicated. Author

N67-11889# Naval Ordnance Lab., White Oak, Md.
A MONTE CARLO CALCULATION TO SIMULATE DETECTOR RESPONSE TO UNDERWATER GAMMA RAYS
Susan W. Madigosky and Donald G. Simons 14 Jul. 1966 70 p refs
(NOLTR-66-140; AD-638725) CFSTI: HC $3.00/MF $0.75

The response function of a scintillation detector surrounded by a monoenergetic gamma-ray source which is uniformly dispersed in an infinite volume of water has been calculated. The method of calculation is that of random sampling (Monte Carlo) and is programmed for the IBM 7090 computer. Rather than starting the sampling by taking gamma-ray sources at random throughout the volume of water the response is determined for a weighted set of secondary gamma-ray sources taken to be on the surface of the

detector system. The spectrum of secondary energies chosen is taken to be the equilibrium flux distribution which is obtained in an infinite volume of water in which there is no detector. The detector response is determined by a superposition of the weighted secondary sources. Detector response has been obtained for gamma-ray sources from Cr51, Cs137, K40, Na24, and Ce144. The calculated response for these sources agrees quite well with the measured response in shape but not in magnitude. Here, it is found that the artificial spectra have an amplitude which is approximately 1.6 times the measured spectra. This difference appears to be mainly due to two sources: the difference in geometry between the actual spectrometer and the 'spectrometer' used for the calculation and the approximation in which the distribution of secondary source neglects the presence of the detector. Author (TAB)

N67-11982*# Avco Corp., Lowell, Mass. Avco Missiles, Space and Electronics Group.

OPTICAL FUNCTIONS FOR MOLECULAR HYDROGEN Final Report

Robert J. Spindler, Jr. 30 Sep. 1966 174 p refs

(Contract NAS3-7990)

(NASA-CR-72107; AVSSD-0287-66-RR) CFSTI: HC $5.00/MF $1.00 CSCL 07D

Franck-Condon factors were calculated for ten band systems of molecular hydrogen. In the X, B, B', C and D states RKR potential curves were used to compute the wavefunctions; in the remainder of the states Morse potentials were employed. The RKR potential curves were constructed at each one-quarter vibrational quantum energy level from spectroscopic data selected from the literature by means of statistical weighting procedure. The Franck-Condon factors were computed for transitions involving each vibrational level up to the dissociation limits of each electronic state in the band systems. The r-centroids for the (0, 0) transition of each system are also reported. Author

N67-12084# Naval Radiological Defense Lab., San Francisco, Calif.

GAMMA RAYS RESULTING FROM INTERACTIONS OF 14.7 MeV NEUTRONS WITH SODIUM, SULFUR, CHLORINE, POTASSIUM AND LEAD

W. E. Thompson and F. C. Engesser 14 Jul. 1966 30 p refs

(USNRDL-TR-1043; AD-638014) CFSTI: HC $2.00/MF $0.50

The prompt gamma rays resulting from the interaction of 14.7 MeV neutrons with the nuclei of the elements sodium, sulfur, chlorine, potassium and lead, were investigated. Cross sections for the production of many of these gamma rays were measured by observing them with a carefully shielded detector during neutron bombardment of a given elemental sample. It was found that the n, n'-gamma process generally predominates and that gamma rays resulting from the deexcitation of the lowest energy levels, with one or two notable exceptions, are usually most prominent. Gamma rays attributable to n, p-gamma, n, alpha-gamma, and n, d-gamma process were also observed. In chlorine and potassium, gamma rays attributable to the n, d-gamma process are unusually preponderant. Some of the most important gamma rays were found to have the following elemental production cross sections (in millibarns per steradian at 90 deg): 0.44 MeV gamma ray from Na, 39.5 plus or minus 4.5; 2.24 MeV gamma ray from S, 15.3 plus or minus 1.7; 2.15 MeV gamma ray from Cl, 17.1 plus or minus 2.0; 2.17 MeV gamma ray from K, 19.3 plus or minus 2.5; 2.62 MeV gamma ray from Pb, 20.3 plus or minus 2.7. Author (TAB)

N67-12094*# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

ELECTRON COLLISION CROSS SECTIONS IN METAL VAPORS Final Report

J. F. Nolan 23 Sep. 1966 30 p refs

(Contract NAS3-7930)

(NASA-CR-72053) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The Townsend α coefficient has been measured in potassium–helium mixtures as a function of E/p, the ratio of electric field to total pressure, and N_K/N_{He}, the ratio of potassium to helium density. By comparing the measured values with the results of a numerical solution of the Boltzmann equation, one obtains cross sections consistent with the measurements. A total excitation cross section for potassium having a peak value of 1.0×10^{-14} cm^2 at 10 eV gives good agreement with experiment. Author

N67-12178*# Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.

AN ANGULAR CORRELATION TEST OF TIME REVERSAL INVARIANCE

Richard A. Kuebbing and Karl J. Casper [1966] 7 p refs

(Grant NsG-655)

(NASA-CR-80122) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A gamma-ray angular correlation experiment is described which is sensitive to the T-violating amplitude. Although it is necessary to measure three separate correlations to determine this amplitude, the experiment is relatively simple in that these are the ordinary two-gamma-ray correlations. The experiment proposed requires a three gamma-ray cascade and the measurement of the second Legendre polynomial coefficient for the 1–2, 2–3, and 1–3 gamma-ray angular correlations. A.G.O.

N67-12200# Pittsburgh Univ., Pa.

PARTICLE PHYSICS AND NUCLEAR DECAY Final Report, Nov. 1961–30 Sep. 1965

Lorne A. Page and James E. Brimhall [1966] 86 p refs

(Grants DA-ARO(D)-31-124-G217; DA-ARO(D)-31-124-G689)

(AROD-3347-7; AD-639228) CFSTI: HC $3.00/MF $0.75

An investigation of positronium and annihilation is summarized. Author (TAB)

N67-12203*# Consultants and Designers, Inc., Arlington, Va.

EFFECT OF RADIATION ATTENUATION UPON THE MOTION OF A RELATIVISTIC PARTICLE IN A UNIFORM FIELD [VLIYANIYE RADIATSIONNOGO TORMOZHENIYA NA DVIZHENIYE RELYATIVISTKOY CHASTITSY V ODNORODNOM MAGNITNOM POLE]

G. E. Gernet 20 May 1966 5 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fizika (Moscow), v. 168, no. 1, 1966 p 63–64

(Contract NAS5-9299)

(NASA-CR-80179; ST-PF-10490) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The effect of radiation attenuation upon the motion of relativistic particles in a uniform magnetic field is evaluated by the behavior of the transverse velocity components for which the approximate equations are derived. Author

N67-12232*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

A PARTIAL WAVE EXPANSION IN SPHEROIDAL COORDINATES FOR DIATOMIC MOLECULES

R. B. Hake and W. Byers Brown 25 Jul. 1966 23 p refs

(Grant NsG-275-62)

(NASA-CR-78974; WIS-TCI-177) CFSTI: HC $1.00/MF $0.50 CSCL 20H

A method for obtaining a convergent partial wave expansion for diatomic systems which employs the use of prolate spheroidal coordinates is described. Included is a discussion of the applicability of the method to the simple one-electron problem of the H_2^+ molecular ion. S.C.W.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N67-11285# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
EFFECTS OF PARTIAL IONIZATION AND PRESSURE ON HYDROMAGNETIC IONIZING WAVES
Ram S. Kushwaha and Allen G. Rubin Jul. 1966 16 p refs /ts Phys. Sci. Res. Paper-239
(AFCRL-66-429; AD-637854) CFSTI: HC $1.00/MF $0.50

The transverse hydromagnetic ionizing wave is studied theoretically without the assumption of infinite conductivity behind the wave. Finite gas pressures are included, as well as a variable degree of ionization behind the wave. The electric field in front of the wave is employed as a parameter. Jump conditions across the wave are solved. It is shown that finite pressure and variation of the degree of ionization are important in some regions Author (TAB)

N67-11358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE INTERACTION WITH LABORATORY PLASMA CONFINED IN A DIPOLAR MAGNETIC FIELD
Robert G. Quinn May 1966 25 p refs
(NASA-TM-X-55576; X-615-66-239) CFSTI: HC $1.00/MF $0.50 CSCL 20I

An experimental technique has been devised to measure the scattering of microwave radiation from a plasma coated magnetized sphere. The relevant literature is reviewed, and the experimental apparatus and techniques are described. Preliminary results of attenuation and phase shift are presented, which indicate that the plasma properties can be determined using this technique. In addition the results provide the radar cross section of a sphere clad with plasma having configurations varying from a spherical shell to a disc. Author

N67-11698*# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
A SURVEY OF CLASSICAL LANGMUIR PROBE THEORY WITH APPLICATIONS TO FLOWING IONIZED GASES Interim Report
Simon H. Schwartz Oct. 1964 25 p refs
(Grant NsG-409)
(NASA-CR-79367; PIBAL-845) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The use of Langmuir probes in ionized gas flows is investigated. First the basic theory of electrostatic probes is investigated and the regimes in which the classical theory is applicable are noted; then a survey is made of literature which modifies the basic theory when the assumptions of classical theory are not met. A survey is then made of literature dealing with the application of basic probe theory to a flowing ionized gas. The modified equations are given. The possible sources of error are enumerated. Finally recommendations are made as to when the classical Langmuir probe can be used in an ionized gas flow, and the equations to use it are given where applicable. It is determined that in most cases the classical theory can be used, with the basic equations unmodified by the flow. In some cases a modification is necessary and the equations are supplied. Author

N67-11714# Princeton Univ., N. J. Plasma Physics Lab.
CUMULATIVE LISTING OF PLASMA PHYSICS LABORATORY (5TH EDITION)
Jul. 1966 90 p refs Includes Suppl.
(Contract AT(30-1)-1238)
(MATT-400; MATT-469) CFSTI: HC $3.00/MF $0.75

A cumulative listing is presented of reports and publications issued by the Princeton University Plasma Physics Laboratory from its inception in July 1951 (under the name Project Matterhorn) to date. NSA

N67-11716# Princeton Univ., N. J. Plasma Physics Lab.
RESISTIVE INSTABILITIES IN TOROIDAL HYDROMAGNETIC SYSTEMS
Russell M. Kulsrud Jan. 1966 16 p refs
(Contract AT(30-1)-1238)
(MATT-424, CONF-651056-2) CFSTI: HC $1.00/MF $0.50

A situation is discussed in which the inclusion of even a small resistance of a plasma makes a drastic change in its stability from that of a zero resistance plasma. The situation considered is basically the so-called min-B system in a torus. The instability in question is the interchange instability. NSA

N67-11869# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
CHARACTERIZATION OF RE-ENTRY PLASMAS [CARACTERISATION DES PLASMAS DE RENTREE]
Jacques Dorey and Claude Véret 1966 25 p refs In FRENCH; ENGLISH summary Presented at the 5th Congr. of the Intern. Council of the Aeron. Sci., London, 12–16 Sep. 1966
(TP-364(1966)) CFSTI: HC $1.00/MF $0.50

Consideration is given to the determination of wave-plasma interactions during reentry in the low layers of the atmosphere. A set of equations permitting a good prediction of the experimental results is developed by taking into account the terms of energy exchanges in the reactions of ionization and recombination. The propagation of electrical and magnetic modes and the possibility of their reciprocal transformation are investigated. The problem of characterization by the analysis of radiations emitted in the optical bands is discussed. C.T.C.

N67-11952*# Humphreys Corp., Concord, N. H. TAFA Div.
PRODUCTION OF SUPERHEATED HYDROGEN PLASMA USING INDUCTION HEATING OF COLD PLASMA AND DC PLASMA ENHANCEMENT
Merle L. Thorpe Washington, NASA, Dec. 1966 22 p
(NASA Order C-69512A)
(NASA-CR-657) CFSTI: HC $1.00/MF $1.50 CSCL 20I

Preliminary experimental investigations were conducted to determine if pure hydrogen could be heated inductively with 25 KW 4 megacycle power. Results are presented which demonstrated that 70% hydrogen in argon can be heated, that direct current and RF plasmas can be operated in tandem with the RF energy added to the exit of a DC plasma gun. Other experiments are discussed with recommendations for apparatus necessary to heat pure hydrogen. Author

N67-11954*# Bunker-Ramo Corp., Canoga Park, Calif.
HOLLOW CATHODE PLASMA PENETRATION STUDY Final Report
Graham Russell, James Litton, and P. B. Myers Washington, NASA, Dec. 1966 38 p refs
(Contract NAS12-9)
(NASA-CR-660) CFSTI: HC $2.00/MF $0.50 CSCL 20I

The objective of this study was to determine whether the electron beam mode discharge (EBMD) is suitable for penetrating the plasma sheath surrounding a reentering vehicle and providing communications. This discharge was first observed in 1960 and has been investigated since. The discharge is formed by a

conventional hollow cathode with a perforated wall. This configuration will discharge in a mode providing an ion collimated electron beam. The beam is stable over a wide range of pressures and voltage. In addition, coherent microwave radiations from the beam have been observed. These properties make the discharge appear desirable for use in reentry communication. Author

N67-12041*# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
STRUCTURE OF THE CURRENT SHEET IN A PINCH DISCHARGE
Rodney L. Burton (Ph.D. Thesis) Sep. 1966 145 p refs
(Grant NsG-306-63)
(NASA-CR-80057; Rept.-783) CFSTI: HC $4.00/MF $1.00 CSCL 20I

The structure of a propagating current sheet in a cylindrical pinch discharge in argon is studied experimentally and analytically. The azimuthal magnetic field, B_θ, is mapped throughout the discharge, yielding patterns of current density, $\vec{j}$. From an inventory of the $\vec{j}\times\vec{B}$ distributions, it is deduced that the bulk of the gas is accelerated to the current sheet velocity. The patterns of radial electric field, E_r, normal to the current sheet, are mapped with a coaxial floating double probe. Based on a one-dimensional, constant compression model, the E_r field appears to be of sufficient magnitude to allow conduction of all axial current by electrons in collisionless $\vec{E}_r\times\vec{B}_\theta$ drift. this field is not strong enough, however, to accelerate ambient ions to the sheet velocity, suggesting that gasdynamic forces also participate in the interaction. This model also identifies ohmic heating in the sheet with the product of radial ion current density and E_r. Comparative measurements in neon, argon, and krypton, keeping the ambient mass density constant, indicate that this ohmic heating decreases with increasing molecular weight. Author

N67-12063*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
AN END EFFECT ASSOCIATED WITH CYLINDRICAL LANGMUIR PROBES MOVING AT SATELLITE VELOCITIES
Richard T. Bettinger Aug. 1966 60 p refs
(Grant NGR-21-002-060)
(NASA-CR-79737; TR-566) CFSTI: HC $3.00/MF $0.75 CSCL 20I

An anomaly in the volt-ampere characteristic of the cylindrical Langmuir probe carried aboard the Explorer XVII Satellite has been observed. This phenomena can be explained as an end effect which becomes important as the angle (θ) between the axis of the probe and the velocity vector of the satellite becomes small. An analytical expression for this end current as a function of θ is derived. This effect may be utilized to experimentally obtain information on the ion temperature and its mass distribution as well as the dimension of the sheath about the probe. It is also suggested that this effect might be utilized to accurately detect the velocity vector of the satellite. Author

N67-12078*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
SHOCK TUBE SPECTROSCOPY AT CHROMOSPHERIC TEMPERATURES Research Progress Report, Oct. 1965-Jul. 1966
T. D. Wilkerson Aug. 1966 26 p refs
(Grant NsG-359)
(NASA-CR-79762; BN-467) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Results of recent spectroscopic experiments with a gas-driven shock tube are described, including technical developments, progress in redundant measurements of plasma state, and data on atomic line strengths for neutral carbon. Author

N67-12130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON ROSTOKER'S TEST PARTICLE THEOREM
C.-S. Wu *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 134-136 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Rostoker's formula is evolved for use with a multispecies plasma within the framework of a Klimontovich formalism. A homogeneous plasma without external field is considered, and the expression is given for the time-asymptotic pair correlation function, which is called the test particle function and written in Fourier transform. The error due to the resulting approximation is treated, and the time-asymptotic solution is solved as an initial value problem. The first term represents the solution without Coulomb interaction, and all particles move along straight lines. The second represents the effect of polarization resulting from Coulomb interactions of the particles of s-species with particles of all species. Thus, the test particle function is viewed as a Green's function which characterizes the interaction between two particles of different species. The result is obtained by integrating for all velocity values and summing over all species. Formulas are also given for long-term asymptotic behavior of the spectral function. M.W.R.

N67-12188# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
STABILITY OF UNIFORM ELECTRICAL CURRENT FIELDS IN CONDUCTING-RADIATING GASES
Kenneth R. Cramer Jun. 1966 24 p refs
(ARL-66-0106; AD-637879) CFSTI: HC $1.00/MF $0.50

The stability of a uniform two-dimensional electrical current field was analyzed with the result that continuum gases are unstable for non zero temperature disturbances when the electrical conductivity of the gas increases with temperature. Filaments or small arcs are predicted to occur between electrodes with different potentials. Filament half-widths were estimated to be very small and not strongly dependent on the peak heat flux potential and they respond to voltage changes in less than a microsecond. The formation of numerous shorting filaments between adjacent electrodes in MHD Hall and segmented electrode devices is suggested as the cause of Hall potential losses. Author (TAB)

N67-12212*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
CALCULATIONS OF OPTIMUM SEED CONCENTRATIONS IN CESIUM AND POTASSIUM NON-EQUILIBRIUM PLASMAS
J. Marlin Smith and F. H. Shair Mar. 1966 23 p refs
(Contract NAS3-6260)
(NASA-CR-79518; R66SD19) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The electrical conductivity of a gas can be enhanced by the use of a mixture of a parent gas of small electron elastic collision cross section (typically a noble gas) seeded with a gas of low ionization potential (typically an alkali metal). Further enhancement for a given gas temperature is possible through the creation of a non-equilibrium condition where the electron temperature is higher than the gas temperature. In this paper an extension for the optimum seed concentration in a non-equilibrium plasma is obtained for conditions applicable to MHD power generators or positive columns of discharges. This result is applied to cesium and potassium seeds and it is shown that the concentration of seed at optimum conductivity is one to two orders of magnitude lower than it is in the equilibrium plasma. Author

N67-12223*# Denver Univ., Colo.
IONIC SOUND WAVES IN PLASMAS Final Report
James B. Calvert Sep. 1966 15 p refs
(Grant NsG-518)
(NASA-CR-79287; DRI-2359) CFSTI: HC $1.00/MF $0.50 CSCL 20I

Apparatus for the study of collision-dominated pressure waves in a plasma has been designed. The plasma is a direct-current glow discharge in ultrapure helium. Acoustic pulses are generated by a diaphragm and detected by an electron-mobility type microphone. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N67-11280# Harvard Univ., Cambridge, Mass. Cruft Lab.
EPR SPECTRA OF IMPURITY IONS IN FERROELECTRIC HOSTS Scientific Report No. 7
David M. Hannon Bedford, Mass., AFCRL, 10 Mar. 1966 165 p refs
(Contract AF 19(628)-3874)
(AFCRL-66-303; AD-638182) CFSTI: HC $5.00/MF $1.00

EPR of Fe(3+), Mn(4+), and Ni(3+) were measured in KTaO3 from room temperature down to 4K. Also some optical absorption spectra of Ti(3+), V(3+), Mn(4+), Ni(2+), and Cu(2+) in KTaO3 are reported Author (TAB)

N67-11678# Delaware Univ., Newark. Dept. of Physics.
THE INFLUENCE OF OXYGEN IN THE ULTRAHIGH VACUUM RANGE ON ELECTRICAL PROPERTIES OF CdS
K. W. Boer and R. Schubert Jul. 1966 15 p refs
(Contract DA-31-124-ARO(D)-173)
(AROD-4461-13; TR-8; AD-637857) CFSTI: HC $1.00/MF $0.50

Measurement of adsorption and desorption of oxygen in the range between 2 x 10 to the -12 power and 5 x 10 to the -6 power torr and corresponding influences on photoconductance on CdS single crystals are reported. Partial pressures were measured with a sensitive mass spectrometer located directly in front of the crystal. A typical desorption curve is given for amu 16. Effects of other gases predominant in the vacuum system such as hydrogen and carbon dioxide were also studied Author (TAB)

N67-11718# Los Alamos Scientific Lab., N. Mex.
DYNAMICS OF DISORDERED HARMONIC LATTICES
Daniel N. Payton, III (Ph. D. Thesis) 8 Jul. 1966 166 p refs
(Contract W-7405-ENG-36)
(LA-3510) CFSTI: HC $5.00/MF $1.00

Extensive numerical and analytic studies of vibrational spectra, normal modes, thermodynamic properties, and dynamical properties of harmonic systems with varying degrees of substitutional disorder have been made. The effects on observable properties of random mixtures of two or more species of atoms with differing masses and differing couplings to nearest- and next-nearest-neighbors have been investigated. Using the IBM-7030 digital computer, spectra for linear chains of 100,000 atoms have been obtained. Calculations in two and three dimensions have been limited to arrays of approximately 1000 atoms. Varying composition, mass ratio, and order affect the spectra in two and three dimensions in ways analogous to those effected in the linear chain. A physical interpretation of the complex nature of the disordered spectrum is given. The effects of disorder on the dynamics of binary disordered harmonic chains have been studied and have been found to be quite pronounced. Author

N67-11810*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORETICAL INVESTIGATION OF ULTRASONIC ATTENUATION FOR FREE ELECTRONS IN THE PRESENCE OF A MAGNETIC FIELD
Lawrence Flax Washington, NASA, Nov. 1966 35 p refs
(NASA-TN-D-3723) CFSTI: HC $2.00/MF $0.50 CSCL 20L

The ultrasonic attenuation theory developed by Cohen, Harrison, and Harrison is reevaluated to include all $q\ell$ values, where q is the phonon wave number and ℓ the electron mean free path. This theory predicts a shift in the extrema as a function of magnetic field, which has recently been observed experimentally. The theory also describes correctly the limiting cases of magnetic field intensity approaching zero and infinity. Tables and graphs are presented for the relative attenuation of transverse and longitudinal waves in the presence of a magnetic field for various $q\ell$ values. Author

N67-11815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF TENSILE STRESS ON CURRENT-CARRYING CAPACITY OF COMMERCIAL SUPERCONDUCTORS
Wayne R. Hudson Washington, NASA, Nov. 1966 14 p refs
(NASA-TN-D-3745) CFSTI: HC $1.00/MF $0.50 CSCL 20L

The effect of tension on the critical current of niobium-zirconium (NbZr) wire and niobium-tin (Nb_3Sn) ribbon at liquid-helium temperature, 4.2°K was determined. The critical currents of the Nb_3Sn samples were measured at 4.14 teslas from zero tension to the breaking point. The critical currents of the NbZr samples were measured at zero magnetic field from zero tension to the breaking point. Critical current characteristics were investigated with the Nb_3Sn sample length both parallel and transverse to the magnetic field. Samples consisted of NbZr wire and Nb_3Sn vapor deposited on stainless steel ribbon. The procedure was to increase the stress by a discrete amount and then increase the current until the sample made a transition to the normal state. Copper-plated Nb_3Sn reached a maximum in critical current density at low values of stress. A maximum in the curve of critical current density against stress was observed when the ribbon was oriented transversely to the magnetic field with the field perpendicular to the ribbon surface. The maximum was typically 20 to 44% higher than the critical current density of the initially unstressed ribbon. The critical current density of all the other samples was nearly constant up to a value of stress slightly below the breaking point and then dropped off sharply. Author

N67-11842*# Johns Hopkins Univ., Baltimore, Md.
CRYSTAL SPECTROSCOPY AT THE JOHNS HOPKINS UNIVERSITY, SEPTEMBER 1966
H. M. Crosswhite and H. W. Moos [1966] 46 p refs Submitted for Publication
(Grant NsG-361)
(NASA-CR-79996) CFSTI: HC $2.00/MF $0.50 CSCL 20L

The free ion and crystal energy $4f^N$ levels are compared for SmIII, HoIII, PrIV, and ErIV. For the divalent spectra, a general depression of some 12,000 cm^{-1} for the 5d crystal bands relative to the free ion levels can be seen. Absorption studies of the trichloride lattice vibronic sidebands associated with Pr^{3+} and Nd^{3+} in $NdCl_3$ show that vibronics of the same type are identical in frequency for the two ions, and that the number of vibronics is very much greater than the number of vibrational modes. In pure $NdCl_3$ and $NdBr_3$ crystals, line splittings of as little as .1 cm^{-1} were observed; these are attributed to nearest and next-nearest neighbor antiferromagnetic and ferromagnetic interactions between the Nd^{3+} ions. In Zeeman studies of $GdCl_3$:Er^{3+} and :Tb^{3+}, made both above and below the Curie temperature, magnetic permeability of high temperatures and field strengths follows an expression derivable from a molecular field model. Also discussed are the multiphonon processes in $LaCl_3$:Nd^{3+}; crystal field calculations; and excited state absorption spectroscopy. M.G.J.

N67-11924# Sperry Microwave Electronics Co., Clearwater, Fla.
PRODUCTION ENGINEERING MEASURE FOR MICROWAVE FERRIMAGNETIC MATERIALS AND CIRCULATORS Quarterly Progress Report, 1 Feb.–30 Apr. 1966
G. R. Harrison, W. C. Heithaus, and D. D. Summers 30 Apr. 1966 71 p refs
(Contract DA-36-039-AMC-06177(E))
(SJ-220-3999-4; QPR-1; AD-639432) CFSTI: HC $3.00/MF $0.75

Ferrimagnetic materials were fabricated during the period for test and evaluation in each of the five frequency bands. Materials were prepared and evaluated in regard to their static and rf properties. The preparation and measured properties are discussed in detail in this report. In addition to material properties, measurement equipment being utilized on this program is described as well as new equipment being fabricated for bulk evaluation of circulator ferrimagnetic materials. Test structure design in three of the five bands (0.7-1.0 GHz, 5.4-5.9 GHz, and 8.2-12.4 GHz) progressed at a satisfactory rate. Test results indicate that additional work is required to bring the structures within specifications at the band edges. However, it was established that performance is reproducible and symmetrical from port to port. In the other two bands (2.0-4.0 GHz and 4.4-5.0 GHz) only minor refinements to existing structures will be required Author (TAB)

N67-11939# Pennsylvania State Univ., University Park. Ordnance Research Lab.
ULTRASONIC REVERBERATION IN SOLIDS FOR LOSS FACTORS EXCLUSIVE OF SCATTERING AND DIFFRACTION
B. E. Droney Washington, Navy Dept., 19 Aug. 1966 106 p refs
(Contract NOW-65-0123-d; Grants AF-AFOSR-43-63; AF-AFOSR-43-65)
(AD-638645) CFSTI: HC $4.00/MF $0.75

A reverberation method is investigated for ultrasonic loss measurements in solids at frequencies above 10 MHz. The diffuse sound field is generated by grain scattering and by reflection at the surface; in equilibrium this sound field consists of a mixture of shear and dilatation waves. The investigation of the energy balance between shear and dilatation for such a uniform diffuse field shows that once equilibrium is reached the energy is mainly contained in shear modes. Measurements of signal level and loss factor characterize the energy distribution throughout the sample as reverberant rather than pulse echo in character, after an initial conversion time required to establish the diffuse field. The decay slope is related to the acoustic loss in the solid and to the losses due to surface effects. Measurements of this reverberant decay slope as a function of frequency, temperature, time, and other parameters such as stress and geometry lead to increased knowledge of loss behavior of acoustic waves in solids. Loss factors in metals measured by the reverberation method from 10 to 100 MHz are frequently orders of magnitude lower than by pulse echo methods, since losses due to scattering are eliminated. (Author) TAB

N67-11949*# Sperry Microwave Electronics Co., Clearwater, Fla.
RESEARCH PROGRAM ON PYROELECTRIC DETECTION TECHNIQUES AND MATERIALS Phase II Final Report
Washington, NASA, Dec. 1966 77 p refs
(Contract NASw-974)
(NASA-CR-629) CFSTI: HC $2.50/MF $0.75 CSCL 20L

Several different materials were tested in an effort to determine materials with strong pyroelectric response. A figure of merit was defined by which one could combine measuresble parameters of materials to determine their potential as detectors. These parameters were measured for several different materials. The result was that barium titanate and tri-glycine sulfate proved to have the most potential as detectors. A single crystalline thine film effort was initiated in an effort to obtain thin film single crystals of high quality for detectors. This was initiated because theory predicts the specific detectivity to be proportional to the inverse square root of thickness. Etching techniques were pursued for the same reasons. Hot spots were observed and studied. Details are included in this report. The Langley effort led to a strong concentration toward ceramic detectors. These were tested in the Hot Shot Tunnel at Langley Research Center. Results of tests are included herein as are details. The theory of the pyroelectric effect was reviewed and changes were made for application to ceramic materials. Author

N67-12091# Pennsylvania State Univ., University Park. Materials Research Lab.
MATERIALS PREPARATION AND CHARACTERIZATION RESEARCH Technical Summary Report, 16 Oct. 1965–30 Jun. 1966
Rustum Roy 30 Jun. 1966 70 p refs
(Contract DA-49-083-OSA-3140; ARPA Order-338)
(AD-637846) CFSTI: HC $3.00/MF $0.75

Research progress and results in the following areas are reported: Growth of 'large' crystals, (flux growth, hydrothermal growth, growth from melt, traveling solvent method, vapor growth); new techniques (crystal growth in gels, plasma synthesis); Application of electron microprobe to the characterization of solids (X-ray wavelength compilation, A-ray spectral shifts in compounds of Si, Al, and Mg); characterization of gel-grown crystals (PbI2 crystals); surface studies of lithium fluoride in varying ambient atmosphere; dislocation studies by X-ray methods; studies of crystal perfection by density and X-ray techniques, (hot-pressed MgF2, precision of lattice parameters of silicon); fuse of a laser ultramicroscope for detection of imperfections in crystals). TAB

N67-12164*# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.
RADIATION EFFECTS ON SILICON Quarterly Progress Report, 1 Jul.–30 Sep. 1966
J. A. Naber and E. G. Wikner 12 Oct. 1966 10 p ref
(Contract NAS7-289)
(NASA-CR-80138; GACD-6249; QPR-7) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Electrical conductivity in high-purity n-type silicon was investigated by the microwave technique after irradiation by 30 MeV electrons at room temperature. Electron-spin resonance studies were made on high-resistivity material to establish a correlation between the microwave resonance and carrier lifetime studies. Further experiments were performed on the formation of the Si-G8 center at 80°K, with subsequent annealing to 300°K. Author

N67-12166*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
FUNDAMENTAL RESEARCH IN SOLID STATE ENERGY CONVERSION PROCESSES Semiannual Technical Summary Report No. 6, 1 Dec. 1965–1 Jul. 1966
1 Jul. 1966 41 p refs
(Grant NsG-496)
(NASA-CR-80136) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Research on the fundamental processes involved in optical behavior of solids and associated with photovoltaic energy conversion is summarized. Consideration is given to studies on graded energy gap heterostructures, cadmium-zinc antimonide solid solutions, electro-optical effect measurements in cadmium telluride, and electrophotoluminescence in cadmium sulfide. A.G.O.

N67-12173*# Chicago Univ., Ill. Dept. of Physics.
COMBINED INTERPOLATION SCHEME FOR TRANSITION AND NOBLE METALS
F. M. Mueller [1965] 53 p refs
(Grant NsG-352)
(NASA-CR-80129) CFSTI: HC $3.00/MF $0.50 CSCL 20L

A combined interpolation scheme is presented for overlapping s-p conduction and d bands. The d bands alone are treated by the tight-binding method. The s-p conduction bands alone are treated by the pseudopotential method. It is shown that there are two important interactions between the bands which are called hybridization and orthogonalization; previous attempts to construct combined interpolation schemes included only the former interaction. By fitting the energy bands of Cu obtained by Segall and Burdick in first-principles calculations, we show that for the d bands alone the two-center approximation is valid to high accuracy. The rms error in the interpolated energy values for the 5-d bands and the lowest conduction band is less than 0.1 eV in both cases throughout the Brillouin zone. The relation of this scheme to resonance theories is indicated, and possible applications of the method are discussed. Author

N67-12190# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
IONIZATION WAVES IN SEMICONDUCTORS AND GASEOUS PLASMAS Scientific Report No. 4
Peter Weissglas and Bengt Andersson 31 May 1966 24 p refs
(Contract AF 61(052)-888)
(AFCRL-66-557; AD-637866) CFSTI: HC $1.00/MF $0.50

A theory for ionization waves in plasmas is developed. If the ionization rate depends strongly on carrier temperature such waves may propagate and an instability which in some cases is absolute, can occur. The wave has a phase velocity opposite the electron drift and can have either positive or negative group velocity. The theory agrees qualitatively, but not in details with that previously developed by Pekarek for striations in gaseous discharges. In particular the theory is applied to InSb, which is a favourable solid state material for observations of ionization waves. Instabilities are predicted for bulk p-type and thin layers of intrinsic material. The possibility of a new kind of negative resistance instability in semiconductors is pointed out Author (TAB)

N67-12195# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
HIGH-FREQUENCY CONDUCTIVITY, CARRIER WAVES, AND ACOUSTIC AMPLIFICATION IN DRIFTED SEMICONDUCTOR PLASMAS Scientific Report No. 5
Kjell Blotekjaer 31 May 1966 88 p refs
(Contract AF 61(052)-888)
(AFCRL-66-567; AD-637867) CFSTI: HC $3.00/MF $0.75

The temperature modulation of charge carriers in a semiconductor is analyzed for a plane wave propagating along a static electric field. The effect of temperature modulation on the rf conductivity is considered. A phenomenological description of energy relaxation, momentum relaxation and intercarrier collisions is used. The expression for conductivity is used to derive a dispersion relation for carrier waves in drifted semiconductor plasmas. Two new waves are introduced by relaxing the assumption of isothermal carrier transport. The theory is applied to a discussion of acoustic amplification in piezoelectric semiconductors. It is shown that the non-isothermal effects limit the maximum gain which can be achieved at high frequencies. (Author) TAB

N67-12228*# Case Inst. of Tech., Cleveland, Ohio.
POSITIVE AND NEGATIVE ION MOTION IN THERMAL OXIDE ON SILICON BY RADIOCHEMICAL AND MOS ANALYSIS
A. B. Kuper, C. J. Slabinski, and E. Yon [1966] 17 p refs Submitted for Publication
(Grant NGR-36-003-067)
(NASA-CR-79727) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Failure of conventional Si planar devices by surface potential shift due to oxide impurities has been studied by combined MOS and radiochemical analysis. Radioactive NaBr contaminant was used to study both anion and cation distributions and kinetics. Experimental evidence is presented that Na in the oxide near the Si interface acts to accumulate electrons at the surface of n-type Si. Less well-known is the role of the anion in determining failure in this mode. At temperatures above 800°C, Br is found to diffuse into the oxide more slowly than Na and partly to neutralize Na^+. Conventional hot-bias drift experiments at 200°C have been extended to include impurity distribution as a function of time within the oxide. The kinetics of Na flow in the oxide to and away from the Si interface compared to Si surface potential shifts suggest the presence of a rapidly-equilibrating negative species which can neutralize Na^+ but not deplete an n-type Si surface. Author

N67-12275*# Research Triangle Inst., Durham, N. C.
CHARGE STORAGE EFFECTS IN MYLAR RESULTING FROM ELECTRON IRRADIATION, JUNE 1965–JUNE 1966
L. K. Monteith, J. R. Hauser, and T. M. Royal Washington, NASA, Dec. 1966 108 p refs
(Contract NAS1-5225)
(NASA-CR-656) CFSTI: HC $3.00/MF $0.75 CSCL 20L

External charge transfer resulting from electron irradiation of Mylar has been observed and a phenomenological model developed which includes space charge build-up, transport of charge during irradiation and the decay of space charge after ceasing irradiation. The spatial symmetry does not strongly influence the external charge transfer characteristics. The depth of trap filling and the spatial extent of trapped charge are the major factors in determining the external charge transfer. The model has been shown to be in reasonable agreement with the experimental observations. Charge storage resulting from electron irradiation of a capacitor structure using Mylar can result in spontaneous discharge events. The spontaneous discharge characteristics depend upon the irradiation electron energy and the flux rate. At flux rates comparable to the Van Allen flux rate, irregular discharge events with a pulse height less than 1 volt were observed. For flux rates in excess of 10^{12} e/cm^2-sec regular pulsing with a pulse height the order of 100 volts was observed. These can be interpreted as partial and complete liberation of the trapped charge respectively. Author

N67-12288# New York Univ., N. Y. Radiation and Solid State Lab.
ELECTROLUMINESCENCE AND BAND GAP IN ANTHRACENE
M. Sano, M. Pope, and H. Kallmann [1966] 5 p refs Submitted for Publication
(AD-635433) CFSTI: $1.20

If anthracene is exposed to high energy radiation, scintillation is observed, and the fluorescence spectrum is identical to that of the U. V. stimulated material. This emission is a result of the radiative decay of the first excited singlet state of anthracene. The question arises whether the recombination of holes and electrons emits light, and even more significant, whether this recombination in their lowest conduction states emit light. Evidence is reported that holes and electrons in their lowest conduction states recombine to produce the first excited singlet state, which then emits the characteristic fluorescence. An important conclusion is that the band gap for electronic conductivity in anthracene is greater than 3.1 eV. Author (TAB)

N67-12290# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
ANGLE-OF-INCIDENCE DEPENDENCE OF CALCIUM FLUORIDE REFLECTIVITY
Alfred Kahan and Donald E. Mc Carthy (East Los Angeles Coll.) May 1966 10 p refs Repr. from Phys. Rev., v. 142, no. 2, 11 Feb. 1966 p 457–462 *Its* Phys. Sci. Res. Paper No. 221
(AFCRL-66-297; AD-635166)

Room-temperature reflectivity measurements of CaF_2 in the fundamental-lattice-vibration region were obtained between frequencies 200 to 650/cm and angles of incidence ranging from near normal to 78°, based on the method of classical oscillator analysis. The near-normal reflectivity is fitted by a two-resonance-frequency model and the corresponding dispersion parameters and optical constants are calculated. From these and the fresnel equations, the reflectivity curves for non-normal angle of incidence are computed and compared with experimental results. It is concluded that the optical constants calculated from the reflectivity at normal angle of incidence can be applied to predict the behavior at non-normal angle of incidence. The angular dependence of the reflectivity is not significant until about 40°, the over-all effect is an increase in reflectivity and, as a consequence, a widening of the sideband on the high-frequency side of the transverse optical mode of vibration. In addition, some of the advantages and disadvantages of classical oscillator theory are commented on. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N67-11249# Stanford Research Inst., Menlo Park, Calif.
ELECTRICAL CONDUCTIVITY OF SOLID AMMONIUM PERCHLORATE Interim Report
Henry Wise 15 Sep. 1966 15 p refs
(Contract Nonr-3415(00))
(AD-639222) CFSTI: HC $1.00/MF $0.50

The electrical conductivity of solid ammonium perchlorate was measured over a temperature range from 500K to 600K. From the variation of the ionic conductivity in an applied electric field as a function of temperature, the enthalpy of formation of lattice defects is found to be 24 kcal and the energy barrier for lattice-defect migration, 20 kcal. The relatively high electrical conductivity of ammonium perchlorate compared with alkali halides and the marked influence of gaseous ammonia on the conductivity are interpreted in terms of a mechanism of charge transfer by proton jump Author (TAB)

N67-11335*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARTICULATE DAMPING IN SOLID PROPELLANT COMBUSTION INSTABILITY
Louis A. Povinelli Washington, NASA, 1966 15 p refs Presented at the 5th Aerospace Sci. Meeting, New York, 23–25 Jan. 1967; sponsored by AIAA
(NASA-TM-X-52252) CFSTI: HC $1.00/MF $0.50 CSCL 21B

The effect of aluminum powder in damping solid propellant instability had been investigated in a vortex burner developed previously. The combustor was composed of a main chamber having a shallow center-perforated grain and a hot gas generator. The generator fed combustion gases tangentially into the main chamber causing transverse mode combustion instability. Aluminum powder was added either to the main propellant or to the gas generator charge. Measurement of the amplitude of the pressure oscillations indicated the effectiveness of the metal acting (a) as an ingredient at the solid surface and in the gas phase, and (b) in the gas phase only. In the absence of aluminum the combustor was unstable, exhibiting an oscillation frequency of 3800 cps with a peak-to-peak amplitude of 55 percent. The addition of fine aluminum powder to the propellant in the main chamber was sufficient to damp out the high-frequency instability. Addition of aluminum to the gas generator propellant only was also effective in eliminating instability provided that an equivalent concentration of metal particles was added. It was concluded that the addition of aluminum powder to solid propellants suppresses instability by acting as an attenuator of sound in the gas phase rather than altering the driving or response of the propellants. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N67-11279# Boeing Scientific Research Labs., Seattle, Wash. Mathematical Research Lab.
INFLUENCE OF ACCELERATION ON COMBUSTION IN A ROCKET ENGINE
F. Edward Ehlers Jun. 1966 68 p refs *Its* Math. Note-470
(D1-82-0541; AD-638993) CFSTI: HC $3.00/MF $0.75

The influence of acceleration was analyzed under the following assumptions: The velocity distribution of the quasi-one-dimensional steady state flow through the nozzle is linear in the axial variable. Combustion occurs at a fixed point in the nozzle and at a constant temperature. Burning rate for a solid propellant is proportional to a power n of the chamber pressure. For a liquid propellant with injection rate unaffected by the acceleration, the ratio of burning rate to injection rate is equal to the power of n of the ratio of the instantaneous pressure and the pressure at an earlier time determined by the time lag in the combustion process. For the liquid propellant with time lag, instability occurs for some values of time lag and of the burning rate parameter n. From the linearized solutions, a stability diagram was drawn in the plane of the time lag and burning rate parameter n. Increasing either time lag or the combustion rate exponent from neutrally stable values produces instability. The effect of increasing the magnitude of acceleration appears to shift the neutral curve to lower values of time lag and the burning rate exponent Author (TAB)

N67-11334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF SEVERAL INJECTOR FACE BAFFLE CONFIGURATIONS ON SCREECH IN A 20,000-POUND THRUST HYDROGEN-OXYGEN ROCKET
Ned P. Hannum and Herbert E. Scott Washington, NASA, 1966 11 p Presented at the 3rd Combust. Conf., Kennedy Space Center, Fla., 17–21 Oct. 1966; sponsored by the Interagency Chem. Rocket Propulsion Group
(NASA-TM-X-52251) CFSTI: HC $1.00/MF $0.50 CSCL 21H

During the test program, seventeen injector face baffle configurations were evaluated. One concentric tube injector with a thrust per element of 50 pounds was used with a 10.77 inch diameter cylindrical combustion chamber, producing a nominal thrust of 20,000 pounds which was used as the basic engine configuration. The results indicate that injector face baffles two inches long produced acoustic stability to the minimum hydrogen injection temperature limit of the test facility, with average maximum compartment dimensions as large as 9.1 inches. A brief discussion of the data obtained is provided, and additional results are given. H.S.W.

N67-11336*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF ACOUSTIC LINERS TO SUPPRESS SCREECH IN HYDROGEN-OXYGEN ENGINES
John P. Wenhainen, Harry E. Bloomer, and David W. Vincent Washington, NASA, 1966 12 p Presented at the 3rd Combust. Conf., Kennedy Space Center, Fla., 17–21 Oct. 1966; sponsored by the Interagency Chem. Rocket Propulsion Group
(NASA-TM-X-52253) CFSTI: HC $1.00/MF $0.50 CSCL 21H

As a part of an extensive investigation being conducted to explore the combustion dynamics of hydrogen-oxygen combustion systems, an experimental study of the use of acoustic liners to suppress screech was conducted in the rocket engine test facility. Liner design variables of open area ratio, liner thickness, liner backing distance, liner length and aperture shape were studied in a 10.78-inch diameter cylindrical combustor at a chamber pressure of 300 psia. The effects of changes in liner design parameters were evaluated by ramping the hydrogen injection temperature down into screech and determining the change in hydrogen temperature stable operating limits. Author

N67-11748# Aeronautical Research Council (Gt. Brit.)
THE PERFORMANCE OF A CENTREBODY PROPELLING NOZZLE WITH A PARALLEL SHROUD IN EXTERNAL FLOW, PART I
R. J. Hard, G. T. Golesworthy, and M. V. Herbert London, HMSO, 1966 34 p refs Supersedes NGTE-M-369; ARC-25993
(ARC-CP-841; NGTE-M-389; ARC-25993) CFSTI: HC $2.00/MF $0.50

The performance of two axially-symmetric centrebody propelling nozzles, with translating parallel outer shrouds and fixed throat areas, has been investigated both in quiescent air and in an external stream having a Mach number range of 1.3 to 2.4. The results confirm that, in quiescent air, translation of the outer shroud gives a high nozzle gross thrust efficiency over a wide range of exhaust pressure ratio. In supersonic external flow, however, the results indicate a noticeable drop in efficiency as the exhaust pressure ratio decreases. A computer program has been written to analyze supersonic shock-free flow through a nozzle, taking into account the effect of any external stream. In general, results for both centerbody nozzles obtained from the computer agree satisfactorily with those obtained from the rig. Computer results have indicated a means whereby the drop in efficiency at low exhaust pressure ratio might be lessened. Author

N67-11953*# Catholic Univ. of America, Washington, D. C.
A SURVEY OF STRUCTURAL DYNAMICS OF SOLID PROPELLANT ROCKET MOTORS
J. H. Baltrukonis Washington, NASA, Dec. 1966 53 p refs (Grant NsG-125)
(NASA-CR-858) CFSTI: HC $2.00/MF $0.50 CSCL 21H

At this point in the development of the art of design of solid propellant rocket motors there are no clear-cut or well-founded methods to quantitatively evaluate the contributions of the propellant to the dynamic responses of the composite structure. A survey of the dynamic problems of solid propellant rocket motors is presented starting from the simplest model thereof and proceeding, step-by-step, to the consideration of more sophisticated and realistic models. The consideration is restricted to infinitesimal deformations of propellant grains with linear mechanical properties. We shall attempt to summarize the pertinent developments and indicate along which lines we feel future study should proceed. A few illustrative solutions are included in areas wherein progress has been substantial. Author

N67-12090# Library of Congress, Washington, D. C. Aerospace Technology Div.
COMMUNIST CHINESE ROCKET PROPULSION TECHNOLOGY. Surveys of Foreign Scientific and Technical Literature
11 Jul. 1966 25 p refs Compilation of abstracts
(ATD-66-89)

Abstracts of Chinese Communist articles published during 1960–1966 are presented. The 31 abstracts are concerned with solid and liquid rocket propulsion technology. Included are the following subjects: (1) shock tube developments; (2) thrust vector control and secondary injection for solid propellant rockets; (3) casing and engine materials; (4) combustion and flame chemistry; (5) stress analyses of cast colid rocket grains; (6) pyrometers; (7) heat transfer in turbojet combustion chambers; (8) film cooling effects; (9) supersonic flow; and (10) mathematical principles of rocket flight. K.W.

N67-12116*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED LIQUID PROPULSION SYSTEMS
L. R. Toth, H. B. Stanford, and W. F. Mac Glashan *In its* Space Programs Sum. no. 37–40, Vol. IV 31 Aug. 1966 p 47–49 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Two solutions are discussed in relation to the problems generated by spacecraft operational requirements for propulsion systems capable of high inherent reliability, long-term storage in space environment, multiple start in free fall (zero gravity), and engine throttling. These include (1) laminating aluminum foil to Teflon film for composite bladder construction, and (2) use of a laser beam process to simulate pinholes in metal foil. M.G.J.

N67-12119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS TECHNOLOGY SATELLITE (ATS) MOTOR DEVELOPMENT
R. G. Anderson and R. A. Grippi *In its* Space Programs Sum. No. 37–40, Vol. IV 31 Aug. 1966 p 73–75 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Results of storage and static firing are reported for the solid propellant apogee motor developed for the Applications Technology Satellite (ATS). After six months of storage, no detrimental effects were observed on the ATS storage units. Static firing is reported for the first combination apogee motor-spacecraft test; and temperature data from the externally mounted thermocouples and other data indicate that the apogee unit functioned nominally in all respects. Another static test shows that the mechanical portion of the safe and arm device can withstand the pressures of temperatures of a full duration apogee motor firing. M.W.R.

N67-12120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE INTERIOR BALLISTICS OF THE FLUID CONTROLLED SOLID ROCKET MOTOR
O. K. Heiney *In its* Space Programs Sum. no. 37–40, Vol. IV 31 Aug. 1966 p 75–79 ref (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The fluid control concept is shown to be a feasible method to obtain a controllable solid rocket motor. To accomplish such a solution, a fully oxidized solid propellant grain is configured with an oversized nozzle throat area so that the propellant alone pressurizes the chamber. A fluid is, therefore, injected into the combustion chamber, and variation of the fluid's mass flow rate will provide operation in a wide pressure range. Because both the grain and fluid are hypergolic, start–stop capability is provided. Steady state motor performance is tabulated; and dynamic responses are graphed for the fluid controlled motor (1) step change to lower injection rate and (2) ramp change to higher injection level. Precise propellant tailoring is far more critical for a fluid control solid motor than for typical solid motors. M.W.R.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N67-11371*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROTON EVENTS IN THE MAGNETOSPHERE ASSOCIATED WITH MAGNETIC BAYS

Andrei Konradi July 1966 28 p refs

(NASA-TM-X-55594; X-611-66-332) CFSTI: HC $2.00/MF $0.50 CSCL 20H

A series of 13 sudden increases in the proton flux was observed at L>8 on the subsolar side of the magnetosphere during August, September, and October 1961. These increases are strongly correlated with the appearance of negative magnetic bays in the auroral zone. The increases exhibit proton intensities of $J(>100\ kev) < 10^6 p/cm^2$ sec ster. The particle intensity rise time is of the order of 10 minutes. The protons have strongly peaked energy distributions and the peak energy decreases with time during a period of about 1 hour from about 300 kev to 100 kev. The events are interpreted as protons drifting in the earth's magnetosphere after being injected into it on the night side. Author

N67-11376*# National Aeronautics anu Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ENERGY SPECTRUM OF COSMIC RAY HEAVY NUCLEI OF CHARGE Z>10 DURING A SOLAR QUIET TIME IN JULY 1961

N. Durgaprasad Aug. 1966 31 p

(NASA-TM-X-55602; X-611-66-366) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The energy spectrum of heavy nuclei was determined in the energy interval from 200–700 MeV/nucleon, using a stack of nuclear emulsions, on a balloon flown from Fort Churchill, Manitoba. The charge and energy spectra were obtained principally from tracks of particles that ended in the detector by a combination of range and δ-ray density measurements. A second charge estimation for particles which stop in the emulsion was made from integral δ-ray counts as a function of range. The energy spectrum was extended up to 700 MeV/nucleon by taking into consideration also the tracks that pass through or interact within the stack using a combination of δ-ray density and multiple scattering measurements that determine the charge and energy of the nuclei. This energy spectrum was combined with the spectra measured for protons and helium nuclei in the same flight and with similar data obtained during 1963 with a view of arriving at a better understanding on the propagation of cosmic ray nuclei in source regions, instellar space and solar system. Author

N67-11378*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OBSERVATIONS OF THE SOLAR WIND INTERACTION WITH THE GEOMAGNETIC FIELD: CONDITIONS QUIET

Norman F. Ness Aug. 1966 58 p refs

(NASA-TM-X-55605; X-612-66-381) CFSTI: HC $2.50/MF $0.50 CSCL 04A

Satellite measurements of the outer geomagnetic field have revealed the distortion and containment of the geomagnetic field and formation of an external magnetic tail as a result of the flux of the solar wind. In addition there appears to be a permanent detached bow shock wave associated with the super-Alfvénic interaction of the solar plasma with the geomagnetic field. Both the shock wave and magnetopause are frequently in motion. Details of the earth's neutral sheet indicate frequent fluctuation of its position in the magnetic tail in the absence of any significant magnetic or solar activity. There remain, however, certain major problems in establishing definitive quantitative models of the physical phenomena which have been observed. It can be anticipated that within 10 years after the discovery of the radiation belts, i.e. 1968, that a great wealth of additional experimental data will be available from the recent sophisticated and high data rate satellites such as EGO's and Pioneers providing definitive as well as simultaneous determinations of separate particle, plasma, and field phenomena. Author

N67-11379*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LONGITUDE DEPENDENCE OF GEOMAGNETICALLY TRAPPED ELECTRONS

Juan G. Roederer, Jasper A. Welch (AFSC, Los Angeles, Calif), and James V. Herod (AFSC, Kirtland AFB, N. Mex.) Aug. 1966 63 p refs Presented at the Inter-Union Symp. on Solar-Terrest. Phys., Belgrade, 28 Aug.–2 Sep. 1966

(NASA-TM-X-55606; X-641-66-382) CFSTI: HC $2.50/MF $0.75 CSCL 04A

A general Fokker-Planck equation is deduced, which describes the distribution of geomagnetically trapped electrons as a function of longitude, time, energy and mirror point field intensity. A special variable for the longitudinal position of a particle is introduced. The coefficients representing longitudinal drift, ionization loss and multiple Coulomb scattering in the Fokker-Planck equation are derived. The physical interpretation of this equation is analyzed for several special cases. It is found that the usual procedure of averaging over longitude in order to obtain a longitude-independent description is not valid for electrons mirroring at low altitudes in the South American Anomaly. The correct procedure is discussed. It is further concluded, that the region East of the Anomaly, initially depleted by precipitation, is replenished by electrons whose mirror points were situated in a narrow "window" in B, before passing through the Anomaly. A very limited extension of the atmosphere in the Anomaly should control this mechanism of replenishment by Coulomb scattering. A small diurnal effect for the low altitude electron flux is predicted, determined by the diurnal variation of the atmosphere in the Anomaly. Author

N67-11507# Joint Publications Research Service, Washington, D. C.

THE SPATIAL DISTRIBUTION OF ABSORBED DOSES OF HIGH ENERGY PROTONS BEHIND A SHIELD

V. Ye. Dudkin, Ye. Ye. Kovalev, V. G. Kuznetsov, and L. N. Smirennyy *In its* Probl. in Aerospace Med. 21 Oct. 1966 p 201–202 (See N67-11401.02-04) CFSTI: $8.40

Deep distributions of doses behind a shield in a plane-parallel phantom irradiated with protons of 126, 250, 415, and 660 MeV indicate that with increased thickness of shield there is a rise in the surface-absorbed dose. This is attributed to accumulation of nuclear reaction products in the shield and increase in the ionization losses of the doses in the phantom itself. For large shield thicknesses there is a decrease in the dose because of the larger number of protons eliminated in the nuclear interactions. With a decrease in incident proton energy, the ionization losses of the protons behind the shield increase and the accumulation of secondary radiation behind the shield decreases. These data were used in the calculation of deep distributions of doses from solar flare protons and radiation belts of the earth behind various shields. M.W.R.

N67-11680# Sacramento Peak Observatory, Sunspot, N. Mex.

X-RAY EMISSION OF FLARES ORIGINATING BEHIND THE SOLAR DISK

Y. I. Vinogradov and N. N. Eryushev [1966] 7 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 28, 1963 p 141–145

(T-26; TT-66-62144; AD-637812) CFSTI: HC $1.00/MF $0.50

It is pointed out that in some cases sudden ionospheric disturbances (SID's) are observed at times when there are no flares on the solar disk. During 1959 there were 18 such cases. It is shown that the detected SID's were due to flares originating behind the limb of the solar disk. Recordings of the integrated intensity of atmospherics in the long-wave range were used as indicators of the SID. Author (TAB)

N67-11688*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.

OBSERVATION OF ABOUT 500 KEV PROTONS IN INTERPLANETARY SPACE WITH MARINER IV

S. M. Krimigis and J. A. Van Allen. Dec. 1965. 14 p refs /*ts* Rept.-65-45

(Grant NsG-233-62; Contract JPL-950613)

(NASA-CR-79364) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The results of observations of protons during a ten month period of interplanetary flight by the Mariner IV spacecraft are reported. The discussion primarily concerns the results from the solid state detector. Graphs which show the daily counting rates of the two channels on the detector are provided. Summary remarks from a preliminary study of the data are made. It is postulated that the low energy protons observed owe their existence to the sun, either by direct emission at essentially the energy observed, or by generation in turbulent regions of the solar wind in interplanetary space. Both alternatives are given consideration; however, the former is favored as a working hypothesis. H.S.W.

N67-11697*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.

INITIAL OBSERVATIONS OF LOW-ENERGY ELECTRONS IN THE EARTH'S MAGNETOSPHERE WITH OGO 3

L. A. Frank. Aug. 1966. 47 p refs /*ts* Rept.-66-39

(Contracts NAS5-2054; Nonr-1509(06); Grant NsG-233-62)

(NASA-CR-79387) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Initial observations of electrons over the energy range extending from ≈100 eV to 50 keV at geocentric radial distances 8 R_E to 20 R_E in the dark hemisphere of the earth's magnetosphere made with electrostatic analyzers are presented. Data from the electrostatic analyzers aboard the Orbiting Geophysical Observatory III are for the inbound pass of the satellite on 12–13 June 1966. The electron differential energy spectra typically are characterized by a single peak in intensities occurring in the energy range ~0.8 to 10 keV and at lower energies with increasing geocentric radial distance, broader widths with decreasing radial distance, and by greater slopes for electron energies $E_e \geq 5$ keV with increasing radial distance. The radial profiles of unidirectional and omnidirectional, integral and differential intensities, and energy densities of electrons within the above energy range are characterized by catastrophic variations in magnitude which are presumably reflections of both temporal and spatial variations in intensities. S.P.

N67-11758# Belgian Royal Observatory, Uccle. Dept. of Radioastronomy and Solar Physics.

SOLAR ACTIVITY IN 1965. PHOTOSPHERIC AND CHROMOSPHERIC OBSERVATIONS, PART I [L'ACTIVITE SOLAIRE EN 1965. OBSERVATIONS PHOTOSPHERIQUES ET CHROMOSPHERIQUES, PARTIE I]

C. Delys and A. Koeckelenbergh. 1966. 18 p refs In FRENCH /*ts* Commun. No. 249

(AR-28) CFSTI: HC $1.00/MF $0.50

Data on photospheric and chromospheric observations and solar activity are tabulated, by month, for 1965. Specific days on which observations of sunspots were made are enumerated. Other tabulated data show the Wolf number, characterizing solar activity, which was determined. Flares, optical instrumentation used, and photographic observations with the Zeiss heliograph are also mentioned. Transl. by R.U.

N67-11968*# Lockheed Nuclear Products, Marietta, Ga.

DATA COMPILATION AND EVALUATION OF SPACE SHIELDING PROBLEMS. RADIATION HAZARDS IN SPACE, VOLUME III

C. W. Hill, W. B. Ritchie, and K. M. Simpson, Jr. Apr. 1966. 182 p refs

(Contract NAS8-11164)

(NASA-CR-76511; ER-7777) CFSTI: HC $5.00/MF $1.00 CSCL 20H

Results of parametric studies investigating the hazards of space radiations in relation to various local and interplanetary missions are discussed. The radiation types include proton and alpha particles emitted in solar flux events and proton and electron particles trapped in the magnetosphere of the Earth. The missions are three Mars expeditions, three 14-day lunar expeditions, and 29 orbital studies. Detectors are located in the eye and abdomen of a man model placed in a cylindrical vehicle composed of either aluminum or polyethylene. The vehicle wall thickness ranges from 1 to 30 gm/cm^2. Descriptions of the principal computer programs employed in these studies are contained in this report. Author

N67-12006# Joint Publications Research Service, Washington, D. C.

STUDIES OF THE INTENSITY AND SPECTRAL COMPOSITION OF LUNAR GAMMA RADIATION BY THE AUTOMATIC STATION "LUNA-10"

A. P. Vinogradov, Yu. A. Surkov, and G. M. Chernov. 25 Nov. 1966. 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 561–564

(JPRS-38793; TT-66-35217) CFSTI: HC $1.00

Gamma spectra of lunar surface rocks which were obtained by the Luna-10 artificial satellite were analyzed to determine the intensity and spectral composition of lunar gamma radiation. Using a scintillation gamma spectrometer, an attempt was made to estimate the relative content of potassium, thorium, and uranium in rocks of the lunar surface. Gamma radiation was recorded in the range of energies from 0.3 to 3.1 MeV and from 0.15 to 1.5 MeV. Measurements covered relatively broad areas of the surface including regions of the continents and seas of both visible and far sides of the moon. Lunar gamma spectra were found to differ greatly from the spectra of terrestrial gamma radiation. Lunar gamma radiation consisted of radiation arising at the time of interaction of cosmic rays with lunar matter and during the decay of cosmogenic radioisotopes. The total intensity of gamma radiation on the lunar surface exceeded that of the earth's crust by 1.5^{-2} with little regional variation. In the total intensity of gamma radiation of lunar rocks about 90% was caused by cosmic rays and not more than 10% was caused by the decay of potassium, thorium, and uranium. These data negated the theory that lunar surface rocks in the areas studied were similar in composition to terrestrial granites. S.C.W.

N67-12007# Joint Publications Research Service, Washington, D. C.

STUDY OF SOFT CORPUSCULAR RADIATION BY THE LUNAR SATELLITE "LUNA-10"

N. L. Grigorov, V. L. Maduyev, S. L. Mandel'shtam, N. F. Pisarenko, I. A. Savenko et al. 25 Nov. 1966. 7 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 567–569

(JPRS-38795; TT-66-35219) CFSTI: $1.00

Presented is an analysis of the operational performance of several gas discharge counters used on the Luna-10 artificial satellite for measuring soft corpuscular radiation in the earth's magnetospheric tail. S.C.W.

N67-12015# Joint Publications Research Service, Washington, D. C.

INVESTIGATION OF COSMIC RADIATION BY THE ARTIFICIAL SATELLITE "LUNA-10"

N. L. Grigorov, V. L. Maduyev, N. F. Pisarenko, and I. A. Savenko 25 Nov. 1966 5 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 565–566 (JPRS-38794; TT-66-35218) CFSTI: HC $1.00

A brief discussion of the performance of two gas-discharge counters which were used on the artificial satellite Luna-10 to record the total level of cosmic radiation in free interplanetary space is presented. The counters had different shielding for separation of cosmic radiation by hardness. The counter designed for recording hard cosmic radiation (galactic cosmic rays and cosmic rays of solar origin) was covered by a copper shield 2.5 g cm^2 thick. The counter designed for recording weakly penetrating cosmic radiation in a solid angle of about 10 sr was covered with a shield identical to that of the first counter but had a thin window at the end with a thickness of 1.2 mg mica+0.3 mg gold per 1 cm^2. The experimentally measured change of the counting rate of the shielded counter between the Luna-10 aposelene and periselene was $11 \pm 3^{\circ}$. Shielding of the moon with an albedo equal to zero should give a change of about 15%. The counting rate of the unshielded counter included data on the weakly penetrating cosmic rays of solar origin and soft radiation in the region of the boundary of the tail of the earth's magnetosphere. S.C.W.

N67-12168*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

THE DYNAMICAL STATE OF THE INTERSTELLAR GAS AND FIELD. II: TURBULENCE AND ENHANCED DIFFUSION

E. N. Parker Oct. 1966 83 p refs

(Grant NsG-96-60)

(NASA-CR-80133; EFINS-66-96) CFSTI: HC $3.00/MF $0.75 CSCL 20H

The dynamical instability of the interstellar gas, caused by the galactic cosmic rays and magnetic field, is examined for the purpose of gaining a more detailed understanding of the phenomenon. The decrease of the field energy as the gas goes into clouds is illustrated with a simple example. It is shown, too, that a tissue of field, formed by superposing alternate layers of field at right angles to each other, fails to produce stability. As suggested earlier, it appears that there is no stable confinement of magnetic fields by the weight of the interstellar gas. It is shown that the instability develops very short wavelengths in the direction perpendicular to the galactic gravitational field and magnetic field. The result is that the interstellar gas must be in a continual state of turbulence and fragmentation, terminating only when the clouds become so dense that self-gravitation becomes dominant. The turbulence and fragmentation enhance ambipolar diffusion to such an extent that the field escapes from the gas rapidly compared to the usual ambipolar rates. It is suggested that this may contribute to the escape of the magnetic fields from the interstellar gas which forms stars. Author

N67-12179*# California Univ., San Diego. Dept. of Physics.

INFRARED LINE EMISSION FROM PLANETARY NEBULAE. I: GENERAL THEORY

Thomas N. Delmer, Robert J. Gould, and William Ramsay [1966] 59 p refs

(Grant NsG-357)

(NASA-CR-80124) CFSTI: HC $3.00/MF $0.75 CSCL 20H

The general physical processes are considered which determine the intensities of infrared emission lines resulting from magnetic dipole transitions between fine structure levels in certain abundant ions. Methods for calculating the ionization equilibrium from data on optical line intensities are developed. Radiative recombination is treated in some detail and general results are given for averaged recombination Gaunt factors. Helium radiative recombination line intensities are computed. By means of the quantum defect method, some additional important collision strengths are calculated. Estimates of the infrared line spectra for a number of planetaries are presented. Author

N67-12208*# Consultants and Designers, Inc., Arlington, Va.

BEHAVIOR OF RADIATION BELTS ANOMALOUS COSMIC RADIONOISE ABSORPTION IN THE AURORA ZONE DURING THE MAGNETIC STORMS OF 12–14 AND 20–21 FEBRUARY 1964 [POVEDENIYE RADIATSIONNYKH POYASOV I ANOMAL'NOYE POGLOSHCHENIYE KOSMICHESKOGO RADIOSHUMA V ZONE POLYARNYKH SIYANIY VO VREMYA MAGNITNYKH BUR' 12–14 FEVRALYA I 20–21 FEVRALYA 1964 G]

S. N. Vernov, V. M. Driatskiy, S. N. Kuznetsov, and V. G. Stolpovskiy 12 Apr. 1966 13 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 1, 1966 p 3–10

(Contract NAS5-9299)

(NASA-CR-80176; ST-PF-GM-10473) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Comparative data on the behavior of electrons of various intensities in the outer radiation belt and auroral zone absorption of cosmic radio noise during geomagnetic storms are presented. Analyzed are data from Electron-1 and Electron-2 artificial satellites. S.C.W.

N67-12208*# Volt Technical Corp., Washington, D. C.

STUDY OF THE SOFT CORPUSCULAR RADIATION ON THE AMS "LUNA-10" [IZUCHENIYE MYAGKOY KORPUSKULYARNOY RADIATSII NA SPUTNIKE LUNY "LUNA 10"]

N. L. Grigorov, V. L. Maduyev, S. L. Mandel'shtam, N. F. Pisarenko, I. A. Savenko et al 28 Oct. 1966 5 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofizika (Moscow), v. 170, no. 3, 1966 p 567–569

(Contract NAS5-12487)

(NASA-CR-80174; ST-LPS-PF-10528) CFSTI: HC $1.00/MF $0.50 CSCL 20H

An analysis of soft corpuscular radiation intensities in the vicinity of the moon which were recorded by gas discharge counters aboard the Luna-10 artificial satellite is presented. S.C.W.

N67-12219*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

MEASUREMENT OF THE CHARGED SPLASH AND RE-ENTRANT ALBEDO OF THE COSMIC RADIATION

Satya Dev Verma (Ph.D. Thesis) Jul. 1966 38 p refs

(Grant NsG-144-61)

(NASA-CR-79516; EFINS-66-71) CFSTI: HC $2.00/MF $0.50 CSCL 20H

A study of the flux and energy spectrum of the proton and electron components of the splash and re-entrant cosmic ray albedo has been made at balloon altitude. The energy spectrum and the flux of the splash and the re-entrant albedo protons has been measured in the energy range from 37 MeV to 334 MeV, at an atmospheric depth of about 4 g/cm^2. The two spectra agree within experimental errors and can be represented by the power laws. Author

N67-12234*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.

EFFECT OF THE RING CURRENT ON THE DISTRIBUTION OF UNBOUND PARTICLES IN THE MAGNETOSPHERE

Perry F. Mc Donald Jun. 1966 63 p refs

(Contract NAS8-20168)

(NASA-CR-78971; R-204) CFSTI: HC $3.00/MF $0.50 CSCL 04B

The effect of the ring current due to the drift of trapped particles in the radiation belts on the distribution of untrapped particles in the magnetosphere is analyzed using a current sheet

approximation to the ring current. The shape assumed for the current sheet is the figure obtained by rotating a dipole field line about the axis. The vector potential of a dipole plus a distributed ring current is derived and applied in Stormer's theorem to determine allowed and forbidden regions of particle motion. Liouville's theorem is used to obtain the ratio of unbound particle flux at points inside the model magnetosphere to an isotropic uniform flux at infinity. Author

N67-12238*# Volt Technical Corp., Washington, D. C.
INVESTIGATION OF COSMIC RADIATION ON THE AMS "LUNA-10" [ISSLEDOVANIYE KOSMICHESKOGO IZLUCHENIYA NA ISKUSSTVENNOM SPUTNIKE LUNA-10]
N. L. Grigorov, V. L. Madzuyev, N. F. Pisarenko, and I. A. Savenko 25 Oct. 1966 4 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofizika (Moscow), v. 170, no. 3, 1966 p 565–566
(Contract NAS5-12487)
(NASA-CR-80172; ST-LPS-CR-01526) CFSTI: HC $1.00/MF $0.50 CSCL 20H

On the basis of observations from the AMS Luna-10, the magnitude of the flux of primary cosmic radiation remains fairly high in spite of solar activity rise begun in 1966, maintaining a value characteristic for solar activity minimum. These data agree well with those obtained two months earlier with the aid of Luna-9. Author

N67-12241*# Consultants and Designers, Inc., Arlington, Va.
COMPTON EFFECT ON RELATIVISTIC ELECTRONS IN THE ATMOSPHERE OF THE SUN [O KOMPTON EFFEKTE NA RELATIVISTSKIKH ELEKTRONAKH V ATMOSFERE SOLNTSA]
A. A. Korchak and Yu. B. Ponomarenko 29 Aug. 1966 10 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 4, no. 3, 1966 p 417–423
(Contract NAS5-9299)
(NASA-CR-80166; ST-PF-CR-SP-10511) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The Compton-effect is considered of thermal photons on relativistic electrons in the atmosphere of the Sun. The calculation of the cross section and power of emission for hard photons is performed for two particular cases: of isotropic distribution of thermal photons and at their radial propagation. The form is investigated of the frequency spectrum of Compton photons for the monoenergetic and the power-law spectrum of relativistic electrons. It is shown that for a power-law energetic spectrum of electrons with the exponent x the emission power increases with the rise of the heliographic longitude of the flare θ according to the law $(\sin \theta/2)^{x+1}$. Author

N67-12242*# Volt Technical Corp., Washington, D. C.
OBSERVATION OF A DIFFUSION WAVE OF RELATIVISTIC ELECTRONS IN THE OUTER RADIATION BELT [NABLYUDENIYE DIFFUSIONNOV VOLNY RELYATIVISTSKIKH ELEKTRONOV VO VNESHNEM RADIATSIONNOM POYASE]
S. N. Vernov, I. A. Savenko, P. I. Shavrin, and M. V. Tel'tsov 16 Sep. 1966 7 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 6, no. 4, 1966 p 661–663
(Contract NAS5-12487)
(NASA-CR-80167; ST-PF-GM-10514) CFSTI: HC $1.00/MF $0.50 CSCL 20H

The case of registration of a diffusion wave of relativistic electrons is considered with the aid of apparatuses installed on the satellite Cosmos-41. The diffusion wave is not accompanied by substantial intensity variations of low-energy protons in the outer proton belt. The estimate of progression velocity of the diffusion wave across L-shells is brought forth. Author

N67-12262*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.
SEVERAL OBSERVATIONS OF LOW-ENERGY PROTONS AND ELECTRONS IN THE EARTH'S MAGNETOSPHERE WITH OGO 3
L. A. Frank Nov. 1966 55 p refs
(Contracts NAS5-2054; Nonr-1509(06); Grant NsG-233-62)
(NASA-CR-80113; Rept.-66-48) CFSTI: HC $3.00/MF $0.50 CSCL 20H

Simultaneous observations of proton (190 eV$\leq$E$\leq$48 keV) and electron 170 eV$\leq$E$\leq$46 keV) differential energy spectrums on L-shells 3.3 to 16 are presented. Peak intensities of protons (30$\leq$E$\leq$48 keV) were observed at L$\simeq$7.0. A preliminary order-of-magnitude estimate of the total energy of trapped protons within the earth's magnetosphere is 5×10^{21} ergs and the estimated contribution from this low-energy proton distribution to the quiet-time terrestrial ring current field at the earth's surface is ~-10 γ. A transient, narrow peak of relatively high low-energy proton and electron intensities within the energy range $\sim$300 eV to 2 keV at L$\simeq$4 with width $\Delta L\sim1$ is also observed. Typical characteristics of proton and electron intensity 'spikes' at peak intensities in the late evening sector of the earth's magnetic tail are (a) approximately equal proton (190 eV$\leq$E$\leq$48 keV) and electron (170 eV$\leq$E$\leq$46 keV) energy densities, $\sim10^{-9}$ erg(cm)$^{-3}$ each, (b) approximately equal proton and electron densities over the above energy range, ~1 (cm)$^{-3}$ each, and (c) largely dissimilar differential energy spectrums, proton spectrums with intensity peaks noncoincident in energy with those of the electron intensity peaks and significantly broader (harder) in the high-energy tail (E$\geq$3 keV) than the relatively steep (soft) electron spectrums in this energy range. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N67-11311# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
PERTURBATIONS OF THE ORBITS OF ARTIFICIAL SATELLITES BY AN ATTRACTION OF EXTERNAL BODIES
Zdenek Kopal Aug. 1966 63 p refs *Its* Mathematical Note No. 478
(D1-82-0558; AD-639050) CFSTI: HC $3.00/MF $0.75

The aim of the paper is to investigate analytically the secular as well as periodic perturbations of the orbits of artificial satellites of the Earth or the Moon, due to an attraction of external masses, by Brown's application of Delaunay's method for the stellar case of three bodies. Two families or orbital perturbations are studied in particular: namely, short-range (secular and periodic) perturbations, arising in the course of a time interval during which the motion of the disturbing third body can be ignored; and long-range perturbations, for which the longitude of the third body becomes a function of the time, but short-range perturbations can be averaged. Analytical expressions for such perturbations of all six elements of the satellite's orbit are given in terms of certain parameters which specify the magnitude of the disturbing force, and the entire analysis carried out to the first powers of these quantities. Author (TAB)

N67-11323*# National Aeronautics and Space Administration, Washington, D. C.
ASTRONAUTICS AND AERONAUTICS, 1965: CHRONOLOGY ON SCIENCE, TECHNOLOGY AND POLICY

1966 666 p refs
(NASA-SP-4006) GPO: HC $2.25; CFSTI: MF $2.50 CSCL 22A

Information pertinent to NASA's manned and unmanned space programs is listed, and significant events are highlighted. The chronology is designed to present in preliminary form information on aeronautical and space affairs; however, sufficient information is provided on less publicized decisions, actions, and discussions so that an understanding of future directions of the space program may be obtained. Appended are listings of satellites, space probes, and manned space flights in 1965; major NASA launchings in 1965; and a summary of manned space flights from 1961 to 1965. H.S.W.

N67-11357*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ACTIVE AND/OR PASSIVE SPACECRAFT ATTITUDE CONTROL
Dennis K. Mc Carthy May 1966 32 p
(NASA-TM-X-55575; X-723-66-216) CFSTI: HC $2.00/MF $0.50 CSCL 22A

This report outlines the feasibility of developing an active attitude control and a passive spacecraft attitude control. It shows the employment of the passive attitude control and its use in conjunction with the active attitude control of a non-spinning spacecraft. Author

N67-11361*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE LONG-PERIOD MOTION IN THE SEMI-MAJOR AXIS OF THE ORBIT OF THE TELSTAR 2 SATELLITE
James P. Murphy Jun. 1966 17 p refs
(NASA-TM-X-55579; X-547-66-260) CFSTI: HC $1.00/MF $0.50 CSCL 22C

A representation for the indirect effect of solar radiation pressure on the semi-major axis of an artificial earth satellite caused by passage in and out of the earth's shadow is examined. The theory is then used to explain the appearance of periodicities in the observed semi-major axis of the orbit of Telstar 2. Author

N67-11372*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DETERMINATION OF THE MAGNITUDE AND BRIGHTNESS FLUCTUATIONS OF THE PAGEOS SATELLITE
S. H. Genatt and J. E. Moye Jul. 1966 30 p
(NASA-TM-X-55595; X-524-66-337) CFSTI: HC $2.00/MF $0.50 CSCL 22A

A passage of the Pageos satellite was observed with the RADOT instrument. By comparing the light intensity recording of the Pageos satellite with a comparison star's recording, the magnitude of Pageos during this pass was computed to be +2.1. Analysis of the light curve of the satellite by a power spectrum routine shows a periodic fluctuation in the brightness with a period of approximately 116 seconds during the same pass. Author

N67-11388*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF USE OF JUPITER GRAVITY TURNS FOR TAILORING TRAJECTORIES TO SATURN WITH CONSIDERATION OF LAUNCH OPPORTUNITIES
Edwin F. Harrison and Charles H. Mc Lellan Washington, NASA, Nov. 1966 57 p refs
(NASA-TN-D-3699) CFSTI: HC $2.50/MF $0.50 CSCL 22C

A trajectory study was conducted to determine several launch opportunities for Earth to Saturn missions, especially for those times when the intermediate planet Jupiter can be passed closely enough to use its strong gravitational field to change the interplanetary-trajectory conditions. The effect of hyperbolic-excess velocity and flight-path angle at departure from Earth on both launch date and trip time are studied for the gravity-turn trajectories. These trajectory characteristics are compared with direct Earth to Saturn trajectory requirements. Passage distance, turning angle, and velocity gained at Jupiter for the gravity-assisted trajectories are examined. Jupiter gravity turns can be utilized for missions to Saturn with launch dates in 1976, 1977, 1978, and 1979, and again starting in about 1996. With the approximate minimum-energy requirement for direct missions to Saturn, a reduction in trip time of about 40 percent was realized for the gravity-turn trajectories over the direct trajectories. By employing a gravity-turn mode, missions to Saturn can also be made with velocity levels at about 1 km/sec lower than the minimum value required for the direct trajectories. This reduction in required velocity can double the payload fraction for a fly-by Saturn mission if a launch vehicle with approximately the same capability as the Saturn V is used. Author

N67-11389*# National Aeronautics and Space Administration, Washington, D. C.
BULLETIN OF ORBITAL INFORMATION. PART I: ORBITAL PARAMETERS [BULLETIN DE RESEIGNEMENTS ORBITAUX. "LA PREMIERE PARTIE: PARAMETRES D'ORBITE"]
Oct. 1966 8 p Translated into ENGLISH from FRENCH
(NASA-TT-F-10468) CFSTI: HC $1.00/MF $0.50 CSCL 22C

The content of the orbital information bulletins is described, and methods for using the information furnished are explained. L.E.W.

N67-11392*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE MOTION OF A SATELLITE OF THE MOON
Giorgio E. O. Giacaglia, James P. Murphy, Theodore L. Felsentreger, E. Myles Standish, Jr., and Carmelo E. Velez Jun. 1966 151 p refs revised
(NASA-TM-X-55295; X-547-65-218) CFSTI: HC $3.25/MF $1.00 CSCL 03C

An analytical solution to the problem of the motion of a lunar satellite is presented. Perturbations of short period and of intermediate period are derived through the application of the von Zeipel method. Long period perturbations are obtained through the use of elliptic integrals. Author

N67-11733*# Volt Technical Corp., Washington, D. C.
DETERMINATION OF THE GRAVITATIONAL FIELD OF THE MOON BY THE MOTION OF THE AMS LUNA-10 [OPREDELENIYE POLYA TYAGOTENIYA LUNY PO DVIZHENIYU ISL "LUNA-10"]
E. L. Akim 2 Nov. 1966 7 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 4, 1966 p 799-802
(Contract NAS5-12487)
(NASA-CR-79543; ST-CM-LPS-10532) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The motion of LUNA-10 is studied in the noncentral gravitational field of the Moon, taking into account the gravitational influence of the Earth, Sun and planets. Eleven coefficients of expansion of Moon's gravitational potential are obtained from trajectory measurements. Pear-like shape of the surface with elongation on the far side of the Moon is evident. It is basically formed under the influence of the terms in potential's expansion containing the cubic harmonic P_3^1 (with the coefficient c_{31}) and the zonal harmonic P_2^0 Author

N67-11739*# Texas Univ., Austin. Engineering Mechanics Research Lab.

FAILURE ANALYSIS OF THE METHOD OF ADJOINT SYSTEMS TO DETERMINE OPTIMAL TRAJECTORIES

Pete Salvato, Jr. (M.S. Thesis) Aug. 1966 127 p refs

(Grant NsG-551)

(NASA-CR-79509; EMRL-TR-1005) CFSTI: HC $4.00/MF $0.75 CSCL 22C

The method of adjoint systems is developed and applied to the solution of the two-point boundary value problem arising from the first necessary conditions for an optimal trajectory. A specific dynamical system is analyzed and various forms of incorrect problem formulation are considered. The sufficiency conditions for a weak minimum are established and the Matrix Riccati equation is shown to evolve from the requirement that the second variation be positive for a minimum. The effects of a conjugate point in the nominal trajectory on the solution of the guidance optimization problem are established through the solution to the Matrix Riccati equation. It is shown that the Matrix Riccati equation can be solved by reducing it to two linear systems of differential equations, which in partitioned form are adjoint to a system of linear differential equations used in the implementation of the computational algorithm of the method of adjoint systems. Through the properties of adjoint systems, a relationship is established which indicates a connection between a breakdown in the method of adjoint systems due to the singularity of a matrix which must be inverted and the presence of a conjugate point in the nominal trajectory at the initial time. Author

N67-11823*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MULTIPLE PLANET FLYBY MISSIONS TO VENUS AND MARS IN 1975 TO 1980 TIME PERIOD

Archie C. Young 6 Oct. 1966 107 p refs

(NASA-TM-X-53511) CFSTI: HC $3.00/MF $0.75 CSCL 22C

A detailed analysis of multi-planet flyby missions to Venus and Mars during 1975 to 1980 time period is presented. Results for multiplanet flyby mission opportunities in 1975, 1977, and 1978 are given. Data are presented for earth departure, planet encounter, and earth return phases of the mission. A comparison of the desirable and undesirable features of a single-planet (Mars) flyby mission and a multi-planet flyby mission is made. A timeline for all of the flyby missions studied is given in terms of earth departure date; planet encounter date, and earth return date. Author

N67-11853*# Massachusetts Inst. of Tech., Cambridge.

RADIO ASTRONOMY

A. H. Barrett et al [1966] 9 p refs

(Contract NSR-22-009-120; Grant NsG-419)

(NASA-CR-79923; QPR-83) CFSTI: HC $1.00/MF $0.50 CSCL 03A

Three studies are briefly reported: (1) an OH interferometric study of the physical conditions responsible for the anomalously intense sources of 18-cm line emission at radio frequencies, aimed at determining the angular dimensions of the emitting regions near the continuum radio sources W3 (IC 1795), W49, Sgr A, and NGC 6334; (2) a low-frequency aperture synthesis of discrete radio sources, in which the fringe visibilities of approximately 24 of the brightest radio sources at a frequency of 234 MHz were measured using a long-baseline interferometer; and (3) observations of the planets Venus and Jupiter as part of a search for atmospheric spectral features, conducted from January to March 1966 at wavelengths near 1 cm, using a 28-ft antenna and a five-channel microwave radiometer operating simultaneously at 19.0, 21.0, 22.235, 23.5, and 25.5 GHz. K.W.

N67-11862# Royal Greenwich Observatory, Herstmonceux (England).

THREE-COLOUR PHOTOMETRY OF THE COMPONENTS IN WIDE DOUBLE AND MULTIPLE SYSTEMS, II. 298 SYSTEMS

Olin J. Eggen 1966 74 p refs

(Bull.-120) HMSO: 10s

A list of photometric results on the (U, B, V) system is given for 652 components in 298 wide double and multiple systems. The tabular data includes magnitudes and colors on the (U, B, V) systems, the (U-B, B-V) relation for main-sequence stars and stars 1^m and 2^m above the main sequence, and young systems for which accurate values of Δ(B-V) and (U, V, W) are available. A.G.O.

N67-11863# Royal Observatory, Edinburgh (Scotland).

THREE-COLOUR PHOTOMETRY OF SOUTHERN GALACTIC CLUSTERS. III: NGC 6167

M. T. Brueck and M. J. Smyth Edinburgh, HMSO, 1966 41 p refs *Its* Vol. 5, No. 10

HMSO: 8s

Photographic UBV photometry, to V=15.7, is carried out for 940 stars near the open cluster NGC 6167. Interstellar absorption over the region is very variable. The distance of the cluster, if genuine, is 1200 parsecs, with an uncertainty of ± 200 parsecs; the age is about 4×10^7 years. 22 OB stars in the neighborhood are located by the Q-method; these may belong to the I Ara association, but do not appear to be related to the cluster. It is pointed out that, where heavy and non-uniform extinction has to be allowed for, the uncertainty of main-sequence fitting is increased by an order of magnitude. Author

N67-11897# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A PRELIMINARY STUDY OF A METHOD FOR IMPROVING POINTING ACCURACY OF A GRAVITY GRADIENT SYSTEM

Walter Edward Davis (M.S. Thesis) Jun. 1966 79 p refs

(GGC/EE/66-8; AD-639579) CFSTI: HC $3.00/MF $0.75

The report is a preliminary study of attitude control in a high altitude satellite in which the gravity gradient stabilization rod is gimballed to produce reaction torques and to augment the gravity gradient restoring torques. The single axis perturbation equation describing the small angle motion of such a configuration is presented. An analytical solution of the steady-state frequency response of the system is carried out and as a result, active system requirements for reducing attitude errors are proposed based on the system response to periodic disturbances. The passive and active system responses are compared. Author (TAB)

N67-11933# Oslo Univ., Blindern (Norway). Inst. of Theoretical Astrophysics.

NARROW BAND STUDIES OF SOLAR BURSTS

Oystein Elgaroy 1966 27 p refs

(Contract AF 61(052)-743)

(AFCRL-66-590; SR-8(57); AD-638192) CFSTI: HC $2.00/MF $0.50

A survey of results obtained with high-resolution radio spectrographs is given and some possible interpretations are indicated Author (TAB)

N67-11961*# Arizona State Univ., Tempe. Coll. of Engineering Sciences.

ATTITUDE STABILITY OF A SPINNING PASSIVE SATELLITE IN A CIRCULAR ORBIT Semiannual Technical Progress Report, 1 Jun.–30 Nov. 1966

Leonard Meirovitch 30 Nov. 1966 54 p refs

(Grant NGR-03-001-014)

(NASA-CR-70262) CFSTI: HC $3.00/MF $0.50 CSCL 22A

The mathematical model consists of a rigid body with two flexible antennas. A simplified model uses two viscously damped oscillators to simulate the antennas. For a body moving in a circular orbit it is convenient to introduce a frame of reference orbiting with the body. This investigation is concerned with the possibility that the motion in which the body undergoes no rotation with respect to the orbiting frame of reference is stable. To this end the direct method of Liapounov is used for the case in which the center of the rigid body is constrained to move in a circular orbit as well as for the unconstrained case. The conclusion is that the orbital constraints assumption just defined is not valid. It is approximately valid if the mass of the oscillators is small relative to the mass of the rigid body. Stability criteria have been derived for three equilibrium configurations which are intimately related to the gravity-gradient stabilization case for the rigid body. Author

N67-11987# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugmechanik.

METHODS FOR THE DETERMINATION AND PREDICTION OF ORBITS OF ARTIFICIAL EARTH SATELLITES [METHODEN ZUR BESTIMMUNG UND VORAUSBERECHNUNG VON BAHNEN KUENSTLICHER ERDSATELLITEN]

H.-P. Heinrich Jun. 1966 138 p refs In GERMAN; ENGLISH Summary

(Contract RFF-2001)

(DLR.-Mitt.-66-06) CFSTI: HC $4.00/MF $1.00

After a short introduction into the fundamentals of satellite motion a summary of approximation methods for determination and prediction of satellite orbits is given, if position and velocity vectors are known by observations. The field of application of some methods used in the USA is characterized, and computational algorithms are given which allow to compute orbits. Author

N67-12005# Joint Publications Research Service, Washington, D. C.

STRATIFIED AND MULTI-FACETED FORMS ON LUNAR PANORAMAS OBTAINED BY "LUNA-9"

V. M. Vakhnin and G. I. Zmiyevskaya 25 Nov. Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 560

(JPRS-38792; TT-66-35216) CFSTI: $1.00

Graphic interpretations of lunar surface faceted and stratified structures which were detected on panoramas obtained by the Luna-9 artificial satellite are cited. S.C.W.

N67-12006# Joint Publications Research Service, Washington, D. C.

MAGNETIC FIELD MEASUREMENTS IN THE NEIGHBORHOOD OF THE MOON BY THE ARTIFICIAL SATELLITE "LUNA-10"

Sh. Sh. Dolginov, Ye. G. Yeroshenko, L. N. Zhuzgov, and N. V. Pushkov 25 Nov. 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 574–577

(JPRS-38797; TT-66-35221) CFSTI: $1.00

Luna-10 measurements of magnetic field strength in the vicinity of the moon are analyzed. Magnetometer readings were used to determine the modulus of the strength of the total vector T of the magnetic field and its components along the axis of rotation and perpendicular to this axis Values of the magnetic field and its components are given A correlation was established between the intensity T and $T_{||}$ of the circumlunar field and the index of magnetic activity at the earth's surface. A field having a dipole character was not discovered nor was the field of the earth's magnetic tail. The possible value of the magnetic tail at a distance of 60 R_E did not exceed 5γ. The most reliable measured value T (perpendicular) averaged 15γ, which exceeds the interplanetary fields in free space at these same indices of magnetic activity. Speculation is made concerning the perturbing effects of the moon as a possible cause of this increase. S.C.W.

N67-12010# Joint Publications Research Service, Washington, D. C.

PRELIMINARY RESULTS OF INVESTIGATION OF SOLID INTERPLANETARY MATTER IN THE NEIGHBORHOOD OF THE MOON

T. N. Nazarova, A. K. Rybakov, and G. D. Komissarov 25 Nov. 1966 6 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 578–579

(JPRS-38798; TT-66-35222) CFSTI: $1.00

Results of Luna-10 measurements of meteor particle impacts in the tail of the earth's magnetosphere and in its extension are analyzed. S.C.W.

N67-12016# Joint Publications Research Service, Washington, D. C.

INDICATIONS OF LUNAR INTERSECTION OF THE TAIL OF THE EARTH'S MAGNETOSPHERE ACCORDING TO DATA FROM CHARGED PARTICLE TRAPS ON THE FIRST ARTIFICIAL LUNAR SATELLITE

K. I. Gringauz, V. V. Bezrukikh, M. Z. Khokhlov, L. S. Musatov, and A. P. Remizov 25 Nov. 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, p 570–573

(JPRS-38796; TT-66-35220) CFSTI: $1.00

Some preliminary results are presented of the Luna 10's charged particle trap measurements made both inside and outside of the earth's magnetosphere. The Luna 10 data indicate that the tail of the earth's magnetosphere extends to approximately 380,000 km. R.N.A.

N67-12044*# TRW Systems, Redondo Beach, Calif.

ADVANCED PLANETARY PROBE STUDY. VOLUME I: STUDY APPROACH

27 Jul. 1966 96 p refs Prepared for JPL

(Contracts NAS7-100; JPL-951311)

(NASA-CR-79500; TRW-4547-6004-ROOO) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Methods used in establishing the study approach are described, and the scientific objectives of conceivable missions are discussed. The functional requirements of a mission are determined, and the influence of these requirements on the generation of spacecraft design concepts is indicated. Spacecraft designs are classified according to the basic mode of attitude control: spin, and 3-axis stabilization. Priority is given to a spin-stabilized spacecraft design for a Jupiter flyby mission in 1972, with a 50-pound science payload. The general types of experimental arrangements and instrumentation to be employed are identified. Also included is the complete statement of work. N.A.S.

N67-12064*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

THE DYNAMICS OF A SPINNING-SOLAR-PRESSURE-STABILIZED SATELLITE WITH PRECESSION DAMPING

John V. Harrington Jun. 1966 26 p refs

(Contract NASr-249)

(NASA-CR-80082; CSR-TR-66-6) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Expressions are derived for the dynamic behavior of both spinning and nonspinning radiation-torqued satellites when their motion is damped by a loss mechanism, sensitive either to the precessional or libration motion of the satellite. Motion equations are formulated with Euler-Lagrange equations and rotational and precessional losses are represented by a Rayleigh dissipation term. Explicit solutions are found for the rotation and precession angles

as functions of time. The coefficient of the Rayleigh dissipation term is further related to the specific measurable parameters of a vibrating viscous damper located on the periphery of the spinning satellite and driven by acceleration parallel to the spin axis. The slow rotation of the solar radius vector prevents the spin axis from ever being completely aligned with the radius vector and, for a constant angular velocity, will cause it to precess at some equilibrium cone angle whose value is determined. Author

N67-12069*# Brigham Young Univ., Provo, Utah.
ANALYSIS AND INTERPRETATION OF MAGNETIC FIELD MEASUREMENTS BETWEEN EARTH AND MARS RECEIVED FROM MARINER IV Semiannual Progress Report, Dec. 1, 1965–Aug. 31, 1966
31 Aug. 1966 30 p refs
(Grant NGR-45-001-011)
(NASA-CR-79398) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Accomplishments are briefly summarized in a continuing analysis of the near Mars magnetic field data, and a search for the extended magnetic tail of the Earth. Geomagnetic fluctuations as observed at a number of ground stations and their relation to magnetic conditions in space were studied. Included are investigations of the gross relationship of the interplanetary field configuration and geomagnetic fluction of M regions, sunspots, etc. on the sun. C.T.C.

N67-12071*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADAR STUDIES OF THE MOON
23 Nov. 1966 21 p refs
(Contract NSR-22-009-106)
(NASA-CR-80080; QPR-4) CFSTI: HC $1.00/MF $0.50 CSCL 03A

The theory of thermal emission from the moon is reviewed in attempt to clarify the types of physical parameters that are related to it. Previous radiometric work is reported and compared to the experimental program underway. The procedures for taking radiometric data and for analyzing it are explained and some results, with preliminary interpretations, are given. Work conducted in increasing the input ephemeris accuracy and in exploring and improving the method of output mapping display is reported. Preliminary results of high-resolution 3.8-cm mapping are given. System development and operations are also covered in relation to progress in an 8-mm radar system. L.E.W.

N67-12077*# Innsbruck Univ. (Austria). Computer Dept.
NUMERICAL COMPUTATION OF SATELLITE ORBITS USING LIE SERIES. COMPARISON WITH OTHER METHODS
H. Knapp Sep. 1966 28 p refs
(Grant NGR-52-046-001)
(NASA-CR-79763; SR-10) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The applications and the advantage s of the Lie series method in celestial mechanics are surveyed. Included in the discussion are the presentation and formulation of the problem, solutions of two-body and three-body problems, estimation of errors caused by breaking off the series, calculation of the perturbation integrals, and numerical computations. Results of the trial computations are assessed in relation to other methods. The point is made that the Lie series converge so rapidly that the method can be employed for calculating the orbits in celestial mechanics, and that good estimates can be given since the theoretical expansion expansions and estimations can be directly applied to general multibody problems. M.G.J.

N67-12092*# Analytical Mechanics Associates, Inc., Uniondale, N. Y.
MISSION LOGIC DEVELOPMENT AND TRAJECTORY PREDICTION, DETERMINATION AND OPTIMIZATION Final Report
Feb. 1965 22 p refs
(Contract NAS9-2527)
(NASA-CR-85557) CFSTI: HC $1.00/MF $0.50 CSCL 22C

In the midcourse guidance analysis, equations were generated for propagating second order perturbation statistics when measurement data is received at a sequence of specified times. Linear feedback control, either continuous or as discrete impulses, was included. With the equations presented, the covariance matrices of perturbations from the nominal system path and of the estimation errors may be calculated. Included is a variant of the Min H optimization procedure which may be used to determine a velocity correction schedule which minimizes a statistical measure of the terminal miss and the fuel used. A modification in the Encke method trajectory computation scheme has been developed and incorporated into the mission analysis program. An anomaly, β, rather than time, t, is used as the independent variable. With this change, Kepler's equations are no longer transcendental and an iterative solution procedure is unnecessary. Furthermore, geometric stopping and printing conditions are often expressed conveniently in terms of β when they would require iterative determinations of t. Testing has show that savings in computer time are as high as 50% or more. Author

N67-12110*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLOW FIELD COMPUTATIONS FOR BLUNT BODIES IN PLANETARY ATMOSPHERES
H. J. Stumpf *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 31–32 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Proposed computer studies for flow field calculations about blunt bodies in a simulated inner planet atmosphere are discussed. The purpose of these programs is defined as the determination by numerical techniques of the state and motion variables, and the convective and radiative heat transfer distributions about spherically blunted and spherically edged very blunt conical bodies, traveling at hypersonic velocities. The free stream conditions and blunt body velocities are to be similar to those encountered in typical hyperbolic Mars entry trajectories where maximum stagnation point convective or radiative heat transfer occur. It is pointed out that the results will be approximately applicable to Venus entry from orbit, when high altitude deceleration is considered. M.G.J.

N67-12150*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE ORBITAL DATA NO. E-5
Beatrice Miller 30 Sep. 1966 39 p
(Grant NsG-87-60)
(NASA-CR-80092; SAO Special Rept.-222) CFSTI: HC $2.00/MF $0.50 CSCL 22C

Tabulated data are presented on the orbital mean elements derived from satellite observations covering several days. These include the Vanguard 2 and 3, the Echo 1, Explorer 9, Transit 4A, Injun 3, Midas 4, Telstar 1, and the A15 Relay; the time period extends from January to June 1963. The data obtained involved use of lunisolar perturbations and tesseral harmonics. S.P.

N67-12153*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
METEOR MASSES AND LUMINOSITY
Franco Verniani 26 Aug. 1966 52 p refs
(Grant NSR-09-015-033)
(NASA-CR-80093; SAO Special Rept.-219) CFSTI: HC $3.00/MF $0.50 CSCL 03B

An analysis is made of the meteor luminous efficiency based on photographic data taking into account the effects of fragmentation. The luminous efficiency τ_p can be expressed as a function of velocity simply as $\tau_p = 1.0 \times 10^{-19} v$, with v in cm sec^{-1} and the luminosity expressed in units of 0-mag stars. The uncertainty

is ±0.1 in the velocity exponent and about 40% in the coefficient. It is confirmed that, in the mass range 10^{-2}–30 g, the luminous efficiency does not depend either on mass or on brightness, nor does it show any appreciable variation in the course of the trajectory. The coefficient, $\tau_{ep} = 1 \times 10^{-19}$ 0 mag g^{-1} cm^{-3} sec^{4}, was established by means of the data on three asteroidal meteors. Once the mass scale was established, meteor densities were determined. Most meteors, both sporadic and shower, have an average density in the vicinity of 0.2 g cm^{-3}. It appears, however, that a small group of sporadic meteors in very short orbits exists, with higher densities of the order of 1 g cm^{-3}. Although it is impossible to estimate the actual consistency of this group, it must represent a very small minority of cometary meteors. Author

N67-12184*# Volt Technical Corp., Washington, D. C.
STRATIFIED AND FACETED SHAPES ON PANORAMAS OBTAINED FROM THE STATION LUNA-9
V. M. Vakhnin and G. I. Zmiyevskaya 24 Oct. 1966 4 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (Moscow), v. 170, no. 3, 1966 p 160
(Contract NAS5-12487)
(NASA-CR-80094; ST-LPS-10527) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Comments on the structures observed on lunar panoramas are presented, together with pertinent photographs. Interpretation of the stratified and faceted shapes in the photographs is discussed, and the possibility of a relationship between the shapes and the mineral composition of the lunar surface is mentioned. L.E.W.

N67-12185*# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Space and Defense Sciences Dept.
LUNAR SURFACE ROUGHNESS COMMINUTION STUDY Final Report, 20 Jul. 1964–7 Apr. 1965
T. P. Meloy and L. H. Faust Apr. 1965 90 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950919)
(NASA-CR-80137) CFSTI: HC $3.00/MF $0.75 CSCL 03B

The roughness of the lunar surface is estimated by considering the process of cratering caused by the infall of meteoric bodies. Size distribution and depth of the resulting dust or rubble layer has been calculated. Individual crater formation is analyzed, and the size distribution of the ejected material from individual craters is computed. The distance that the material is thrown is also computed. Using a matrix method, an estimate is made of the size distribution and depth of the dust on the moon as a function of time. It is concluded that near the edge of a new, large crater a number of large debris blocks can be expected and hazardous landing conditions would exist in this region. A.G.O.

N67-12172*# California Univ., Berkeley. Space Sciences Lab.
MOVIE OF THE INTERPLANETARY MAGNETIC FIELD
John M. Wilcox, Arthur Douglas Ritchie (Lawrence Radiation Lab., Livermore, Calif.), and Norman F. Ness 14 Oct. 1966 15 p refs Submitted for Publication *Its* Ser. no. 7, Issue no.53
(Grant NsO-243-62; Contract Nonr-3656(26))
(NASA-CR-80128) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A 16mm movie is described which represents a portion of the magnetometer observations made by the IMP-1 satellite during 1–14 Dec. 1963. The movie represents approximately 12 days of interplanetary field observations, beginning with the second orbit of IMP-1. It is noted that the movie emphasizes in a unique way the dynamic character of the interplanetary field. A.G.O.

N67-12180*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
ANALYSIS OF LUNAR SURFACES Final Report, Feb. 1961–Jul. 1965
Anthony Turkevich May 1966 18 p refs
(Grant NsG-127-61)
(NASA-CR-75121; EFINS-66-49; EFINS-66-47) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A method for chemical analysis of lunar and planetary material by use of alpha particles was investigated, and analytical procedures for an alpha-scattering experiment on a suitable lunar vehicle were developed. The method makes use of the interactions of a collimated beam of energetic, heavy, charged particles, with matter, to determine the chemical composition of the sample being analyzed. Fundamental studies on this method have been carried out in parallel with the development of instruments designed to meet the requirements of specific space missions. In discussing the results of these studies consideration is given to the scattering of alpha particles, the protons produced by alpha particles, the role of ionization energy loss by charged particles in interpreting the spectra of scattered alpha particles and protons, and an interpretation of complex spectra in terms of chemical composition. Future prospects of the technique are also mentioned with particular emphasis slanted toward use on the Surveyor Lunar Mission. A.G.O.

N67-12202*# Consultants and Designers, Inc., Arlington, Va.
SCIENTIFIC RESULTS OF PROCESSING OF PANORAMAS OBTAINED FROM PHOTOGRAPHS OF THE LUNAR SURFACE TAKEN FROM "LUNA-9"
A. L. Lebedinskiy 13 Jun. 1966 13 p Transl. into ENGLISH From Reprint of the USSR Acad. of Sci., 1966
(Contract NAS5-9299)
(NASA-CR-80180; ST-LPS-10493, rev. 1) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Scientific processing of three panoramas transmitted from the lunar surface by a Soviet television camera at respective heights of 7, 14, and 27° of the sun above the lunar horizon, revealed that the landing station was located on the slope of a depression. Morphological comparison of the different panoramas led to the conclusion that tiny details of the lunar surface structure are: (1) lunes or craterlets of small dimensions with hardly noticeable rims; (2) linear structures usually intersecting one another in various directions; and (3) stones. The predominating type of relief in the portion studied constituted circular pits, craters, funnels, and craterlets having a minimum dimension of about 5 cm. Judging from shadows, the steepness of the inner slopes of craterlets with dimensions of more than one decimeter may exceed 41°. On a whole, the picture observed near the lunar station corresponded to a gradual disappearance of a superficial layer's matter. G.G.

N67-12204*# Consultants and Designers, Inc., Arlington, Va.
CHARGED DUST PARTICLES IN INTERPLANETARY SPACE [O ZARYAZHENNYKH PYLEVYKH CHASTITSAKH MEZHPLANETNOGO PROSTRANSTVA]
N. B. Divari 31 Mar. 1966 11 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 43, no. 1, 1966 p 192–197
(Contract NAS5-9299)
(NASA-CR-80178; ST-IM-PF-10487) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Inferences following from the assumption that dust particles of interplanetary space are electrically charged, are discussed. It is shown that in this case a natural explanation befits a series of observed regularities in the zodiacal light, the gegenschein, the twilight glow and in noctilucent clouds. The possibility is shown of circumterrestrial dust cloud replenishment by submicron dust, always "blown away" by the solar wind from the lunar environment. The submicron particles are trapped by the geomagnetic field, forming the most stable component of the circumterrestrial dust cloud. Author

N67-12205*# Volt Technical Corp., Washington, D. C.
DETERMINATION OF ABOVE-ATMOSPHERE DIMENSIONS OF METEORITES [OPREDELENIYE DOATMOSFERNYKH RAZMEROV METEORITOV]
A. K. Lavrukhina 26 Sep. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Astron. (Moscow), v. 168, no. 6, 1966 p 1275–1278
(Contract NAS5-12487)
(NASA-CR-80177; ST-ACH-CR-10513) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The absence of data on above-atmosphere dimensions of meteoritic bodies and the position of those specimens having fallen on Earth constitutes one of the most essential gaps in our knowledge of meteorites. The only method allowing evaluation of the above-atmosphere dimensions of meteorites is the study of the depth distribution of the formation rate of cosmogenous isotopes arising in nuclear interactions of cosmic rays with the meteoritic matter. The accuracy of the assumed method resides mainly in the precision of radiometric methods and the correctness of the adopted hypothesis on the constancy of spatial distribution of cosmic rays in the solar systems. The method is practically applied in the case of the Yardymlin iron shower. Author

N67-12207*# Goodyear Aerospace Corp., Akron, Ohio.
AN INDICATED SPECULAR DEGRADATION RATE FOR ALUMINIZED MYLAR SURFACES IN NEAR-EARTH ORBIT FROM RECENT PHOTOMETRIC OBSERVATIONS OF THE ECHO I SATELLITE
Richard H. Emmons 17 Jun. 1964 16 p refs Presented at the 116th Meeting of the Am. Astron. Soc., Flagstaff, Ariz., 24–27 Jun. 1964
(Contract NAS1-3114)
(NASA-CR-80175; GER-11521, rev. A) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Photometric measurements were made of the Echo I satellite with a visual comparison photometer on 1 March 1964. The data, taken over a wide range of phase angles (143 to 32 deg) and normalized for slant range, are best fitted in illuminance versus Russell's phase function by a surface model that is 96 percent specular and 4 percent diffuse. This indicates that the actual specular degradation rate for aluminized Mylar surfaces in a near-earth orbit, due to the combined effects of all environmental factors, is less than 1 percent per year. Together with the results from laboratory hypervelocity impact tests of very small particles on aluminized Mylar, the present indications may prove of value in further defining the micrometeoroid environment at Echo I's orbital height, either with respect to the flux in the vicinity of the mass cutoff or the mass cutoff itself. The present indications should also prove of value in predicting the useful life in nearby space of exposed optical and thermal balance surfaces. Author

N67-12217*# Chrysler Corp., New Orleans, Space Div.
OPTICAL TECHNOLOGY APOLLO EXTENSION SYSTEM, PART I. EXECUTIVE SUMMARY REPORT
21 Oct. 1966 32 p
(Contract NAS8-20256)
(NASA-CR-79522) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Evaluation of the optical technology Apollo extension system for application in astronomy, meteorology, and planetology experiments led to the conclusion that an orderly program for the advancement of optical technology is needed. This program should consider the following recommended experiments: (1) Optical heterodyne detection on earth and spacecraft; (2) direct detection space-to-ground; (3) communication with 10 megahertz bandwidth; (4) precision tracking of a ground beacon; (5) point ahead and space-to-ground-to-space loop closure; (6) transfer tracking from one ground station to another; (7) phase correlation measurements; (8) pulse distortion measurements; (9) primary mirror figure test and correction; (10) thin mirror nesting principle and erection and alignment of large optics in space; (11) fine guidance; (12) comparison of isolation techniques; (13) interferometer systems; and (14) segmented optics. G.G.

N67-12224*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
LOW-THRUST TRAJECTORY CAPABILITIES FOR EXPLORATION OF THE SOLAR SYSTEM USING NUCLEAR ELECTRIC PROPULSION
A. L. Friedlander Oct. 1966 62 p refs
(Contract NASr-65-06))
(NASA-CR-79297; T-17) CFSTI: HC $3.00/MF $0.75 CSCL 22A

This report presents the trajectory energy requirements for low-thrust (electric propulsion) flight throughout the solar system, first for the general class of flyby missions in points in and above the ecliptic plane, and then for flyby, capture, and orbiter missions to the planets Mercury through Pluto. The trajectory energy requirements are described in terms of the parameter "J"—defined as the time integral of thrust acceleration squared. Application of these results is for the most part limited to electric propulsion systems operating at constant power, i.e., nuclear-electric systems. Results for the general class of flyby missions are presented as accessible regions contours of J and flight time. Results for the planetary missions are presented as graphs of J vs flight time. The payload/flight time capabilities of two conceptual nuclear-electric spacecraft designs are illustrated in terms of the accessible regions graph and summarized for each of the planetary missions. Author

N67-12235*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
COMPUTATION OF DEBRIS PROBLEM CAUSED BY ACTIVE SEISMIC SHOTS ON THE LUNAR SURFACE
Charles Broder May 1966 60 p refs
(Contract NAS8-20166)
(NASA-CR-78970; R-197) CFSTI: HC $3.00/MF $0.75 CSCL 03B

Impact densities and velocity distribution of the debris resulting from explosions on the lunar surface were determined. Consideration is given to the type of soil that will give the best empirical data. Crater volumes and shapes are predicted, and the ejecta patterns determined are based on radial ejection of material from the charge center. Author

N67-12239*# Consultants and Designers, Inc., Arlington, Va.
SCIENTIFIC RESULTS OF PROCESSING OF PANORAMAS OBTAINED FROM PHOTOGRAPHS OF THE LUNAR SURFACE TAKEN FROM "LUNA-9"
A. I. Lebedinskiy 26 May 1966 13 p Transl. into ENGLISH from reprint of the USSR Acad. of Sci., 1966
(Contract NAS5-9299)
(NASA-CR-80171; ST-LPS-10493) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Results from the preliminary processing of "LUNA-9" moon surface photographs are presented. Three panoramas are shown with the sun at 7°, 14°, and 27° above the lunar horizon. Based on the consideration of images and morphological comparisons of monotypic details in various regions of the panorama, characteristic types of microsculptures are outlined and tiny details of the lunar surface structure are described. A.G.O.

N67-12246*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE FUTURE OF SPACE TRAVEL
Wernher Von Braun 13 Oct. 1966 15 p
(NASA-TM-X-59138) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The future of space travel and exploration, and its peaceful applications to astronomy, agriculture, meteorology, cartography, hydrology, geography, and oceanography, are briefly sketched. Technological progress is also mentioned on: the Apollo spacecraft, Saturn V launch vehicle, lunar landing vehicles, manned flybys of Venus and Mars, communications satellites, and remote sensors. The speech ends on the note of peaceful international cooperation towards man's destiny in space. R.U.

N67-12247*# Volt Technical Corp., Washington, D. C.
MEASUREMENTS OF THE MAGNETIC FIELD IN THE VICINITY OF THE MOON ON THE AMS LUNA-10 [IZMERENIYA MAGNITNOGO POLYA V OKRESNOSTI LUNY NA ISKUSSTVENNOM SPUTNIKE LUNA-10]
Sh. Sh. Dolginov, E. G. Yeroshenko, L. N. Zhuzgov, and N. V. Pushkov 31 Oct. 1966 7 p refs Transl. into ENGLISH from Dok. Acad. Nauk SSSR, Geofiz. (USSR), v. 170, no. 3, 1966 p 574–577
(Contract NAS5-12487)
(NASA-CR-79545; ST-PF-LPS-10530) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The intensity of the magnetic field in the vicinity of the Moon has been measured; and a correlation was established between the intensity T and the index of magnetic activity on the surface of the Earth by analogy with identical intensity correlation with interplanetary fields. No field of dipole nature and field variation has been revealed. No Earth's magnetic tail was detected. The possible value of the magnetic tail at the distance of $60R_E$ does not exceed 5γ. The most reliably measured quantity T constitutes as an average 15 γ and exceeds the interplanetary fields in free space for the same indexes of magnetic activity. Author

N67-12248*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
EVALUATION DIFFERENCES ON MARS
Carl Sagan and James B. Pollack 10 Oct. 1966 52 p refs
(Grant NGR-09-015-023)
(NASA-CR-80110; SAO Special Rept.-224) CFSTI: HC $3.00/MF $0.50 CSCL 03B

A variety of meteorological observations were analyzed to refute the assumption that observations of apparent frost phenomena occurring in Martian bright areas are elevations. Conversely, it was concluded that the polar cap recession data suggest the dark areas are highlands, because of the greater wind velocities and frost-vaporization rates anticipated for highlands. From the quasi-specular component of the radar power reflectivity, and from the radar Doppler spectra, both as a function of Martian longitude, the Martian dark areas are found to have systematically higher elevations than the adjacent bright areas. Mean slopes of a few degrees are deduced, and elevation differences up to 17 km are inferred. Results reported bear on the discrepancy between ground-based infrared spectrometric and Mariner 4 occultation values of Martian surface pressures. R.U.

N67-12251*# Volt Technical Corp., Washington, D. C.
SIGNS OF CROSSING BY THE MOON OF THE EARTH'S MAGNETOSPHERE TAIL ACCORDING TO DATA OF CHARGED PARTICLE TRAPS ON THE FIRST ARTIFICIAL SATELLITE OF THE MOON (LUNA-10) [PRIZNAKI PERESECHENIYA LUNOY KHVOTA MAGNITOSFERY ZEMLI PO DANNYM LOVUSHEK ZARYAZHENNYKH CHASTITS NA PERVOM ISKUSSTENNOM SPUTNIKE LUNY]
K. I. Gringauz, V. V. Bezrukikh, M. Z. Khokhlov, L. S. Musatov, and A. P. Remizov 27 Oct. 1966 6 p refs Transl. into ENGLISH from Dokl. Acad. Nauk SSSR, Geofiz. (USSR), v. 170, no. 3, 1966 p 570–573
(Contract NAS5-12487)
(NASA-CR-80107; ST-PF-LPS-10529) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The results presented in this paper are based only upon the preliminary data from the first two traps. Even these stem from still unfinished measurements. The main conclusions derived are evidence that during the experiments the Moon, alongside with its satellite, emerged from the tail of the Earth's magnetosphere in which there are electron fluxes with $E_e > 70$ ev, and then, as the May fullmoon approached, entered that tail again. Therefore, the distance from the Earth in the antisolar direction increases from ~200,000 km, according to data from IMP-1, to ~380,000 km according to data from LUNA-10. Author

N67-12252*# Volt Technical Corp., Washington, D. C.
DETERMINATION OF INTEGRATION CONSTANTS IN THE GENERALIZED PROBLEM OF TWO FIXED CENTERS
E. I. Timoshkova 10 Oct. 1966 14 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Astron. (Leningrad), v. 13, no. 3, 1966 p 113–123
(Contract NAS5-12487)
(NASA-CR-80142; ST-CM-10522) CFSTI: HC $1.00/MF $0.50 CSCL 03C

A method is proposed for the determination of six integration constants in the problem of two fixed centers. The expressions are also derived for the spheroidal coordinates of the moving point in terms of power series by two small parameters. Author

N67-12257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SEPARATION OF TWO BODIES IN SPACE: A MACHINE PROGRAMMED ANALYSIS USING THE LAGRANGE EQUATIONS AND EULERIAN ANGLES
T. H. Mack and R. G. Chamberlain 15 May 1966 152 p refs
(Contract NAS7-100)
(NASA-CR-80115, JPL-TR-32-912) CFSTI: HC $3.25/MF $1.00 CSCL 22C

This report presents a development of the Lagrangian equations of motion and a FORTRAN computer program for the motion of two rigid bodies in space, separating as a result of any one, or a combination of, the following force mechanisms: springs with ball ends, springs with one end guided, pyrotechnics, rockets, cold-gas jets, air pistons, and coulomb drag. Two constraints, treated by the method of Lagrange multipliers, are included as options. These constraints are the pin-puller delay and the hard-mounted spring constraint. The pin-puller delay represents the situation when one discrete separation device (e.g., a pin puller) actuates later than the others, providing a ball and socket type of joint prior to final separation-device firing. The hard-mounted spring constraint takes into account the fact that sliding, at the tip of a guided spring, is usually prohibited either by design or by inherent friction. The forces arising from the various mechanisms are represented by the customary mathematical models. The classical equations of motion are numerically integrated by the Adams-Moulton method. Author

N67-12271*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
RADAR DOPPLER SPECTROSCOPY OF MARS. I: ELEVATION DIFFERENCES BETWEEN BRIGHT AND DARK AREAS
Carl Sagan, James B. Pollack, and Richard M. Goldstein (JPL) 6 Sep. 1966 79 p refs
(Contract NAS7-100; Grant NGR-09-015-023)
(NASA-CR-80134; SAO Special Rept.-221) CFSTI: HC $3.00/MF $0.75 CSCL 03A

Effective topographical resolution of radar observations of Mars at the 12.5 cm wavelength are reported. The correlation between high reflectivity at radar frequencies, and dark areas at optical frequencies applies to the central longitude of the Martian features, to the extent of the features, and to their relative reflectivity rankings at the two frequencies. Theory is reviewed as

to whether the dark areas of the Martian surface are elevations or depressions. The hypothesis that the dark areas are elevations is systematically examined in the 36 Doppler spectrograms of the 1965 opposition. Radar data suggest that dark areas slope gently downward from the center of the dark area scanned. The Martian surface is considered to be similar to that of Earth, were the oceans removed, the effects of water erosion eliminated, and the relief enhanced by the ratio of the gravitational accelerations of the two planets. The dark areas are similar to continental blocks, and this conclusion bears adversely on those theories of continental origins that depend on the existence of a liquid planetary core. R.U.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N67-11281*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MECHANICAL DESIGN OF SPACECRAFT
1 Aug. 1962 86 p refs Seminar Proc. held 28 Mar.–23 May 1962 (Contract NAS7-100)
(NASA-CR-79531) CFSTI: HC $3.00/MF $0.75 CSCL 22B

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3. SCIENTIFIC INSTRUMENT DESIGN AND INTEGRATION B. A. Waitman p 17–32 (See N67-11284 02-14)
4. SPACECRAFT MECHANICAL SUBSYSTEMS AND MECHANISMS R. A. Barlow p 33–39 (See N67-11285 02-31)
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N67-11282*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENCE AND ENGINEERING IN SPACE
W. J. Schimandle *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 1–8 refs (See N67-11281 02-31) CFSTI: HC $3.00/MF $0.75

Discussed are various aspects of the spacecraft engineers's task together with some background and information related to this work. Design of a spacecraft has to take the specific mission and its requirements in consideration; after the proper problems are formed, solutions are developed, finally optimized and translated into action. The engineer carries the proposed solution into physical being, the hardware is tested, and the results are fed back into the beginning of the process. Typical trajectories are outlined for a chemically propelled spacecraft in lunar or interplanetary missions, as well as design and engineering mechanics for the Mariner Centaur configuration. G.G.

N67-11283*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT DESIGN
James N. Wilson *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 9–17 (See N67-11281 02-31) CFSTI: HC $3.00/MF $0.75

The design process for a Mariner launch configuration is described from conception through last minute changes. This spacecraft is to be launched all folded up after being fitted inside the nose-shroud booster. After separating from the booster it unfolds solar power panels; the use of gas jets and some logic from sun sensors located on the spacecraft will orient it towards the sun and unfold its parabolic high-gain antenna. Step after step in the design process is outlined and some prototype cruise configurations are shown. G.G.

N67-11285*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT MECHANICAL SUBSYSTEMS AND MECHANISMS
Richard A. Barlow *In Mech. its* Design of Spacecraft 1 Aug. 1962 p 33–39 (See N67-11281 02-31) CFSTI: HC $3.00/MF $0.75

Discussed are design considerations for open-loop type actuators and the structures necessary to aim or position such components as science instruments, communications equipment, and power equipment at various attitudes. Examples shown are the solar panel and the plasma boom, the planetary horizontal platform, and the magnetometer boom developed for the purpose of positioning scientific instruments at long distances from the spacecraft and holding them in a fixed position. G.G.

N67-11286*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE APPLICATION OF STRUCTURAL ENGINEERING TO SPACECRAFT DESIGN
Neil E. Johnson *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 40–48 ref (See N67-11284 02-31) CFSTI: HC $3.00/MF $0.75

Projected are structural design, analysis, and testing procedures utilized in the construction and evaluation of the Mariner I spacecraft. The major components of the spacecraft are its hexagonal structure, the solar panels, the superstructure, and the high gain antenna. The design process takes place in the following steps: (1) preliminary design; (2) initial structural design; (3) development tests of prototype structures; (4) final structural design; (5) structural tests of complete spacecraft; and (6) redesign if necessary for optimization. G.G.

N67-11287*# Jet Propulsion Lab., Calif. Inst. of Tech. Pasadena.
A SUMMARY OF THE TEMPERATURE-CONTROL PROBLEMS OF INTERPLANETARY SPACECRAFT
Donald W. Lewis *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 49–54 refs (See N67-11281 02-31) CFSTI: HC $3.00/MF $0.75

Thermal control problems of interplanetary spacecraft cover a wide range from the thermal environment during the prelaunch and boost phases of a trajectory to the effects of the Earth, the Sun, and the atmosphere on a low orbiting vehicle before it is boosted into an interplanetary trajectory. Additional considerations include the cruise period trajectory where very small heat-flow rates affect the equalization temperature of the vehicle. The most pronounced effect on the design of an adequate temperature control system is caused by intensity changes in solar radiation; in the vicinity of Venus, solar radiation is approximately twice as intense as near Earth. Analytical solutions to the heat transfer problems encountered depend on the limitations that the definition of the boundary conditions impose. It is demonstrated that vacuum and heat-sink properties can be adequately approximated for heat transfer studies by realistic spacecraft evaluation in a vacuum chamber with the help a of radiation form factometer. G.G.

N67-11289*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SPACECRAFT DESIGN PROBLEM
James L. Adam *In its* Mech. Design of Spacecraft 1 Aug. 1962 p 66–73 (See N67-11281 02-31) CFSTI: HC $3.00/MF $0.75

Integration of paraboloids of revolution in spacecraft systems centered on design and construction of various antenna, mirror, and reflector geometries. Presented examples were a Mariner high-gain antenna with woven mesh as parabolic portion, a later generation Mariner antenna of honeycomb-sandwich design and foldable mechanism to fit into the shroud, a foldable antenna built of balsa wood, a solar foam-rigidized parabolic solar reflector of aluminized mylar, and various prototype metal mirror structures made either from hinged petals or by one piece type construction. G.G.

N67-11321*# Martin Co., Denver, Colo.
COMPILATION OF FLIGHT DATA FROM TITAN III VEHICLES
J. Newgent Dec. 1966 412 p
(Contract NAS1-6483)
(NASA-CR-66204) CFSTI: HC $4.61/MF $2.00 CSCL 22D

Descriptions are presented for the Titan III flight vehicles and the vibration, acoustic, and shock data acquired during the flight and ground test programs from inception through December 1965. Data are presented for four Titan IIIA core vehicles and for three Titan IIIC core vehicles (boosted with strap-on solid rocket motors). Pertinent information relative to the data acquisition systems and vehicle trajectories also is included. Author

N67-11328*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
SURVEY OF OPERATION AND COST EXPERIENCE OF THE X-15 AIRPLANE AS A REUSABLE SPACE VEHICLE
James E. Love and William R. Young Washington, NASA, Nov. 1966 12 p refs
(NASA-TN-D-3732) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The X-15 airplane has been flown more than 150 times in an environment similar to that anticipated for many of the reusable space vehicles being studied. Data are presented on X-15 development and operational costs, turnaround time, and refurbishment cycles, based upon actual operation of the aircraft. For example, 27 flights were accomplished in 1964 at a total cost of $16,268,000, or an average cost of more than $602,000 per flight. It is believed that information from the X-15 program will be helpful in feasibility studies of the reusable-vehicle concept, inasmuch as the X-15 operation is more directly comparable than any other operational program to the reusable systems being considered. Author

N67-11340*# Space Craft, Inc., Huntsville, Ala.
FEASIBILITY STUDY OF AN AERONOMY SATELLITE, Final Report
5 Aug. 1966 30 p refs
(Contract NAS5-9346)
(NASA-CR-79700) CFSTI: HC $6.00/MF $1.25 CSCL 22B

Preliminary findings are presented for an aeronomy study to investigate the properties of that atmospheric region whose lower limit overlaps regions accessible by sounding rockets and whose upper limit extends into regions presently mapped by aeronomy satellites. Two satellite concepts are examined in which the energy lost to drag is periodically restored by means of a multiple-start propulsion system. Orbit lifetimes are considerably increased over the nonpropelled case for a given mission profile. This brief survey of the potential application of propulsion to aeronomy satellites demonstrates the feasibility of a detailed study. The inclusion of a propulsion system provides for very low perigee orbits that extend data gathering excursions well under present altitude limits. S.P.

N67-11347*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECTIVENESS OF SYSTEMS TESTS IN ATTAINING RELIABLE EARTH SATELLITE PERFORMANCE
A. R. Timmins Washington, NASA, Nov. 1966 11 p ref Presented at the Inst. of Environ. Sci., San Diego, Calif., Apr. 1966 (NASA-TN-D-3713) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Laboratory tests on complete systems have been a vital part of the effort to attain high reliability for earth satellites. The effectiveness of this approach is examined by summarizing the laboratory results on 64 spacecraft. These results are used to compare in-house and out-of-house performance with respect to the number of problems and environments on both prototype and flight spacecraft. The in-house data are further developed to show the effect of time and thermal level on the detection of problems in a simulated space environment. Comparisons of space problems with simulated space problems are made with respect to number and location. The distribution of space problems with respect to time is presented and discussed. The space performance is used to show the merits of the test philosophy and test program, and also to suggest areas of improvement. Author

N67-11348*# National Aeronautics and Space Administration, Washington, D. C.
FIRST ATS LAUNCH SET, DECEMBER 6
2 Dec. 1966 36 p
(NASA News Release-66-57) Available from the Scientific and Technical Information Division CSCL 22B

A narative account is presented on the Applications Technology Satellite (ATS) program and on the satellite ATS-B scheduled for launching December 6, 1966. The communications, technology, and scientific experiments are discussed, and details on the orbit and launching are given. The power, control, and command and telemetry subsystems are described, and the ground stations and tracking activities are covered. N.E.N.

N67-11368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HISTORY OF ORBITING SOLAR OBSERVATORY OSO-2
Apr. 1966 121 p
(NASA-TM-X-55590; X-440-66-322) CFSTI: HC $3.00/MF $0.75 CSCL 22B

The mission objectives, development, and operation of Orbiting Solar Observatory (OSO-2) are related. Experiments aboard each OSO spacecraft are designed to observe the sun and solar phenomena and to measure electromagnetic radiation produced by these phenomena in the ultraviolet X-ray and gamma ray region of the spectrum which is absorbed or reflected by the earth's upper atmosphere. The history of the OSO development includes a description of the OSO-B disaster and accident investigations. S.P.

N67-11381*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE METEOROID SATELLITE PROJECT PEGASUS First Summary Report
W. G. Johnson et al Washington, NASA, Nov. 1966 116 p refs
(NASA-TN-D-3505) CFSTI: HC $3.00/MF $0.75 CSCL 22B

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4. OPERATIONAL ASPECTS OF PROJECT PEGASUS W. G. Johnson p 55–64 (See N67-11385 02-31)
5. METEOROID DATA RECORDED ON PEGASUS FLIGHTS J. B. Dozier p 65–76 (See N67-11386 12-31)
6. SECONDARY MEASUREMENTS BY PEGASUS G. B. Heller, R. D. Shelton, and J. B. Dozier p 77–111 refs (See N67-11387 02-31)

N67-11382*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRUCTURAL DESIGN AND DATA SYSTEMS OF SPACECRAFT
William G. Johnson *In its* The Meteoroid Satellite Proj. Pegasus Nov. 1966 p 4–17 (See N67-11381 02-31) CFSTI: HC $3.00/MF $0.75

The mechanical structure of the Pegasus spacecraft, designed to fit within the boilerplate model Apollo service module and service module adapter, is described. In the deployed configuration, the wing space is approximately 29.3 m; the width, 4.1 m. To obtain data on the hazards from meteoroid penetration, 2024 aluminum was chosen as the target material for the sensors. Three thicknesses are used: 0.04 mm, 0.2 mm, and 0.4 mm. The six major electronic subsystems–power, communications, data, detector, attitude, and temperature–are discussed, and schematics are included. The temperature, attitude, and meteoroid detection systems are identified as of prime importance in the data collection subsystem, and are described in detail. M.G.J.

N67-11383*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL DESIGN CONSIDERATIONS
Gerhard B. Heller *In its* The Meteoroid Satellite Proj. Pegasus Nov. 1966 p 18–28 (See N67-11381 02-31) CFSTI: HC $3.00/MF $0.75

The factors affecting the electronic canister thermal design are assessed, with the final evaluation resulting in the use of an active louver system which prohibits radiant heat flow through the window in the cold case, but allows an outflow of heat in the hot case. It is reported that the louver system has maintained the electronic temperatures within acceptable ranges in all three Pegasus vehicles since the beginning of their flights. Details are given on the thermal analysis of the canister which consisted of desk calculations of representative average heat balance equations, and detailed studies based on a complex computer program for validating the desk calculations. The computer analysis evaluated the calorimetric heat balance equations without resorting to the use of averaging; the thermodynamic model was broken down into 45 nodes with 45 simultaneous first-order differential equations. A series of thermal vacuum tests were also undertaken to verify and develop the thermal design. M.G.J.

N67-11384*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METEOROID DETECTOR DEVELOPMENT AND TESTING
Mary J. Smith *In its* The Meteoroid Satellite Proj. Pegasus Nov. 1966 p 29–54 (See N67-11381 02-31) CFSTI: HC $3.00/MF $0.75

The factors influencing the choice of the detector to be used on the Pegasus satellites are delineated, and the development and testing of various sensor systems are discussed. Design concepts and studies are reviewed, along with the fabrication techniques which evolved. Data on tests conducted to determine the effects of hypervelocity impact and of electron radiation on the detectors are also presented. It is pointed out that the final detector panel is designed to permit relatively easy manufacture with reasonable yield rates of acceptable units, to limit the effects of temperature extremes on the structures, and to be self-shadowing from back impacts. M.G.J.

N67-11385*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPERATIONAL ASPECTS OF PROJECT PEGASUS
William G. Johnson *In its* Meteoroid Satellite Proj. Pegasus Nov. 1966 p 55–64 (See N67-11381 02-31) CFSTI: HC $3.00/MF $0.75

The methods and facilities used at the Satellite Control Station (Satcon) to evaluate Pegasus performance in flight, and to control on-board operations are discussed. The relationship of Satcon to other functional elements in the Satcon operation is shown. The three phases of Satcon operations are discussed: launch operations; flight from liftoff through the first two orbits; and the routine operational phase initiated at the end of the second orbit, during which Satcon schedules the normal operational commands to the spacecraft, and receives, records, displays, and analyzes data from the spacecraft. Pegasus I performance is assessed, and it was concluded that the meteoroid penetration data collected from the 0.04 mm detectors are quite usable; those from the 0.2 mm detectors are usable; and those from the 0.4 mm detectors are questionable. Modifications made in the Pegasus II and III configurations, as a result of the Pegasus I data, are listed. M.G.J.

N67-11386*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METEOROID DATA RECORDED ON PEGASUS FLIGHTS
James B. Dozier *In its* Meteoroid Satellite Proj. Pegasus Nov. 1966 p 65–76 (See N67-11381 02-31) CFSTI: HC $3.00/MF $0.75

The penetration data and the derived flux figures are presented, together with a discussion of how these numbers were determined. Operational procedures and the functioning of the satellite systems in flight are described from the standpoint of data collection and data analysis. The number of punctures, area–time exposure, and puncture frequency observed by Pegasus I, II, and III are summarized, and the time history of cumulative hits for all three panel thicknesses (0.04 mm, 0.2 mm, and 0.4 mm) is plotted. M.G.J.

N67-11387*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SECONDARY MEASUREMENTS BY PEGASUS
Gerhard B. Heller, Russell D. Shelton, and James B. Dozier *In its* Meteoroid Satellite Proj. Pegasus Nov. 1966 p 77–111 refs (See N67-11381 02-31) CFSTI: HC $3.00/MF $0.75

Details are given on the 19 pulse amplitude modulated and 6 pulse code modulated digitized temperature probes used for temperature measurements on the Pegasus spacecraft. The thermal data from these probes are used to determine the temperature status of components for evaluating spacecraft operation, to evaluate the effectiveness of the thermal design techniques used to maintain proper temperature control of the temperature-sensitive components, to analyze the effect of the space environment on the thermal design, and to better determine the thermal environment of space. The electron sensor used for radiation measurements is also described; it consists of a shielded scintillator with photomultiplier tube and an electronic data processing unit which reduces discrete pulse information to analog voltage outputs for subsequent transmission to the ground. For measuring the rigid body motion of Pegasus, the orientation time history of all three-body axes is determined by on-board sensors which detect the sun and earth vectors with respect to the satellite body-fixed axes. M.G.J.

N67-11390*# National Aeronautics and Space Administration, Washington, D. C.
BIOSATELLITE A: FIRST IN SERIES OF SPACE STUDIES
9 Dec. 1966 41 p
(NASA News Release-66-312) Available from the Scientific and Technical Information Division CSCL 22B

Background information on the objectives, experiments, and flight scheduling of the biosatellites is presented. It is pointed out that the most important factor of space flight conditions that cannot be simulated on earth is weightlessness. During the flight of Biosatellite A, effects of weightlessness on various life processes will be studied on pepper plants, wheat seedlings, frog eggs, and amoeba at three different levels: growth and form of entire plants and animals, structure of growth of cells and tissues, and basic biochemistry of the cell. A second objective of Biosatellite A is to determine whether the effects of radiation on organisms in weightlessness are the same, greater, or less than on earth. Details are also given on general biology experiments, the Delta Launch Vehicle, tracking and recovery, flight sequence, and the biosatellite project team. L.E.W.

N67-11395*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OSO SPACECRAFT MANUAL
Jul. 1966 149 p refs
(NASA-TM-X-55616; X-440-66-348) CFSTI: HC $3.00/MF $1.00 CSCL 22B

A spacecraft manual for the Orbiting Solar Observatory (OSO) is presented for use by experimenters and sub-contractors in preparing hardware for the spacecraft. The OSO is described, including sail structure, wheel structure, static and dynamic structural balance, magnetic balance, and prelaunch tests. Extensive details are also given on the telemetry system, command system, power supply and distribution, antenna system, experiment complement, spacecraft and experiment temperature monitoring, and launch program. L.E.W.

N67-11721*# Goodyear Aerospace Corp., Akron, Ohio.
STUDY OF EXPANDABLE, TERMINAL DECELERATORS FOR MARS ATMOSPHERE ENTRY. VOLUME I Final Summary Report, Dec. 1965–Oct. 1966
Jay L. Musil 21 Oct. 1966 130 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951153)
(NASA-CR-79526; GER-12842, Vol. I, Rev. A) CFSTI: HC $4.00/MF $1.00 CSCL 22B

This study has as a basis the analytical formulation of the effects associated with the modal environments of Mars and specific entry capsule characteristics and entry conditions. The main objective was to determine fundamental engineering system design requirements for initial-stage, expandable decelerator devices that provide stabilization and retardation for Mars lander capsules. The following characteristics were analyzed: (1) structural integrity; (2) performance effectiveness; (3) aerodynamic stability; (4) bulk and weight; (5) heat insulation; (6) materials; (7) ancillary equipment; (8) deployment and inflation; and (9) packaging. The characteristics of various decelerators were determined by engineering analyses and design, and decelerators that retard capsules to about Mach 1 near heights of 10,000, 20,000, and 30,000 ft above the Martian surface were selected for detailed investigation. In conclusion, comparisons and recommendations are made regarding desirable configurations, areas of additional studies, and simulation and test requirements. K.W.

N67-11734*# Volt Technical Corp., Washington, D. C.
LUNA-12 TRANSMITS PHOTOGRAPHS ["LUNA-12" PEREDAYET SNIMKI]
3 Nov. 1966 6 p Transl. into ENGLISH from Pravda (Moscow), 30 Oct. 1966 6 p
(Contract NAS5-12487)
(NASA-CR-79544; ST-PR-LPS-10534) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Two photographs of the lunar surface taken by LUNA XII are discussed. The photographs were taken from an altitude of 100 km above the Moon and represent an area of the Mare Imbrium. Also mentioned is the lunar orbit of the probe. K.W.

N67-11809*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FULL-SIZE PILOT-CONTROLLED DOCKING SIMULATION OF THE APOLLO COMMAND AND SERVICE MODULE WITH THE LUNAR MODULE
Jack E. Pennington, Howard G. Hatch, Jr., and Norman R. Driscoll Washington, NASA, Dec. 1966 37 p refs
(NASA-TN-D-3688) CFSTI: HC $2.00/MF $0.50 CSCL 22A

The simulation was been completed by using a six-degree-of-freedom dynamic simulator. The study was designed to investigate the pilot's ability to complete a successful docking by using only visual information. Several thruster failures and three vehicle control modes were simulated. Results indicated that, with adequate visual aids and with no thruster failures, docking by using the primary control mode is not a difficult maneuver. Control-system failures increased the terminal docking errors and tended to reduce the pilot's confidence in his ability to control the vehicle precisely. Author

N67-11866*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL DESIGN EVALUATION OF PEGASUS
Roger Linton Washington, NASA, Dec. 1966 53 p refs
(NASA-TN-D-3642) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Three particular areas were selected for this analysis: (1) the micrometeoroid detector panels, (2) the louver system, and (3) the service module adaptor. Results indicate that the thermal design of the three Pegasus spacecraft was successful and adequate in most respects. A significant part of this success was, however, due to the small eccentricity of the satellite orbits. The thermal design was accomplished on the assumption of a highly eccentric orbit with a T_s(per cent time in sunlight) approaching 90 per cent; a more circular orbit was eventually chosen, too late for thermal design changes, and with a correspondingly lower value of T_s. It is apparent, upon studying post-launch temperature data, that the effect of this change was to maintain the Pegasus temperature more closely within the designed tolerances. Author

N67-12046*# TRW Systems, Redondo Beach, Calif.
ADVANCED PLANETARY PROBE STUDY. VOLUME 2: SPIN-STABILIZED SPACECRAFT FOR THE BASIC MISSION
27 Jul. 1966 567 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951311)
(NASA-CR-79502; TRW-4547-6006-R0000) CFSTI: HC $8.66/MF $2.50 CSCL 22B

A detailed description is presented for a 500-pound, spin-stabilized spacecraft which can carry 50 pounds of scientific payload on a flyby of Jupiter using the Atlas/Centaur booster with a solid propellant third stage. Discussed are the functional requirements placed on this precursor mission, as well as the effects of using a spin-stabilized spacecraft to attain these requirements. The system aspects of the 1972 Jupiter flyby are reviewed, and preliminary designs of each of the spacecraft subsystems are given. Analyses of design reliability, a feasible schedule for its implementation, its costs, and the cost effectiveness factors are considered. N.A.S.

N67-12048*# TRW Systems, Redondo Beach, Calif.
ADVANCED PLANETARY PROBE STUDY. VOLUME 3: ALTERNATE SPACECRAFT AND MISSIONS
27 Jul. 1966 263 p Prepared for JPL
(Contracts NAS7-100; JPL-951311)
(NASA-CR-79501; TRW-4547-6006-R0000) CFSTI: HC $6.00/MF $1.25 CSCL 22B

A 3-axis stabilized, 50-lb science payload spacecraft is described in detail, including functional requirements, spacecraft system concept, problem areas, comparison with Mariner Mars,

spacecraft system, subsystem designs, reliability, schedule, cost estimate, and cost effectiveness. It was felt that the 3-axis system is feasible for a 1972 Jupiter mission, although it has lower reliability than the spin-stabilized version (0.70 as compared with 0.79). Three alternate spacecraft configurations, which carry 12-, 100-, and 250-lb science payloads, are also considered. The implications for Jupiter flyby missions in 1973 to 1980 are discussed, and the effects of the changed requirements during these years on spacecraft design are analyzed. Flyby missions to planets beyond Jupiter and orbiter missions about Jupiter are then considered. The possibilities and problems centering on capsule entry mission are briefly reviewed, and the cost effectiveness of all these missions is reported. Finally, a brief presentation is made of alternate spacecraft configurations. L.E.W.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N67-11317# California Univ., Berkeley. Structural Engineering Lab.
A STUDY OF A MULTIPLE INTEGRAL REPRESENTATION OF THE CONSTITUTIVE EQUATION OF A NONLINEAR VISCOELASTIC SOLID
V. V. Nels and J. L. Sackman Jul. 1966 94 p refs *Its* Rept.-66-9
(Contract DA-31-124-ARO(D)-460)
(AROD-4547-13; AD-639221) CFSTI: HC $3.00/MF $0.75

The applicability of a functional polynomial of third degree for the constitutive equation of a nonlinear viscoelastic polymer has been investigated. A method for the determination of the kernel functions appearing in the one-dimensional creep formulation has been discussed. Creep measurements of tension and compression in low density polyethylene under single step, two step, and three step loading histories are described. The analysis of this data has provided a basis for the determination of the creep kernel functions. For the loading range used in the tests, the Volterra-Frechet multiple integral expansion of the constitutive functional of low-density polyethylene has been found to be adequately represented by the three term integral representation. A number of cases of general load histories were investigated. A close comparison between the experimental response to these loading histories and the response predicted by the three term integral representation was obtained. Author (TAB)

N67-11397*# Boeing Co., Seattle, Wash. Aerospace Group.
CRYOGENIC STORAGE SYSTEM STUDY PROGRAM (AES PAYLOADS) Technical Final Report, Feb. 1–Aug. 1, 1966
Huntsville, Ala., NASA. Marshall Space Flight Center, 2 Nov. 1966 296 p refs
(Contract NAS8-20272)
(NASA-CR-61154) CFSTI: HC $3.75/MF $1.50 CSCL 22B

Extensive details are given on the development of LH_2 and LOX fuel storage systems for a lunar mission. Both active (vent gas cooled) and passive thermal protection systems were studied. Study ground rules and assumptions, initial investigations, preliminary design studies, development plan, and complete system test plans are covered. Some of the conclusions reached include: (1) Spherical tanks provide lower system weights than cylindrical tanks. (2) A single tank for containing a specific quantity of usable cryogen results in less storage system weight than mutiple tanks. (3) LH_2 storage system launch weights range from 3 to 4 times the weight of usable LH_2; however, launch weight of a LOX storage system is less than 1.2 times the weight of usable LOX. (4) A minimum-weight LH_2 storage system can be achieved only through increased complexity. (5) The use of fiberglass in tension rod supports provides a heat leak so low that benefits to be gained in using disengaging mechanisms appear nil. L.E.W.

N67-11398*# Boeing Co., Seattle, Wash. Aerospace Group.
CRYOGENIC STORAGE SYSTEM STUDY PROGRAM (AES PAYLOADS) Summary Technical Report, Feb. 1–Aug. 1, 1966
Huntsville, Ala., NASA. Marshall Space Flight Center, 2 Nov. 1966 56 p
(Contract NAS8-20272)
(NASA-CR-61155) CFSTI: HC $2.50/MF $0.50 CSCL 22B

The results of a design and analytical investigation undertaken to define LH_2 and LOX storage systems for a lunar mission are summarized. A simultaneous investigation was conducted on a wide variety of thermal protection systems and structural support design. Four storage systems (three for LH_2 and one for LOX) were selected for preliminary designs and detailed thermal analysis. The LH_2 storage systems were rated on payload weight and volume, confidence in achieving mission goals, and extent of development required. Development plans were developed that identified the tasks necessary to proceed toward the final design of LH_2 storage systems. L.E.W.

N67-11883*# Wyle Labs., Inc., Huntsville, Ala.
FATIGUE OF REINFORCED CONCRETE DUE TO COMPLETE REVERSAL LOADING Technical Memorandum No. 65-2
G. Chan [1966] 17 p
(Contract NAS8-11217)
(NASA-CR-79529) CFSTI: HC $1.00/MF $0.50 CSCL 13M

The tests were conducted to obtain information to aid in the design of reinforced concrete structures, subjected to a high intensity sound field or any form of severe vibration. Seven beams were tested statically to determine the tensile strength of the specimens; the remainder were tested dynamically with complete reversal loading to establish a stress-cycle curve for the material. The stress-cycle plot of the test results indicates that the endurance limit of the specimen is about 60%. All specimens failed in concrete under tension. The reinforcing steel at the middle of the beam appeared to add no tensile strength to the specimens. The equipment used in the tests is described and additional test results are given. H.S.W.

N67-11884*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
FATIGUE OF REINFORCED CONCRETE DUE TO SINUSOIDAL AND RANDOM LOADINGS
G. C. Chan Jul. 1966 90 p refs
(Contract NAS8-5384)
(NASA-CR-79530; WR-66-40) CFSTI: HC $3.00/MF $0.75 CSCL 13M

This report describes an experiment of reinforced concrete beams under dynamic loadings. Specially designed scale beams were vibrated with sinusoidal and random inputs to the foundations. These beams were 1.5"×3.5"×25" in size. The coarse aggregates–fine aggregates and the reinforcing steel were carefully scaled in order to simulate an ordinary reinforced concrete structure. Load-cycle curves for forty seven beams under sinusoidal tests and twenty one beams under random tests were measured. A few light weight, lightly reinforced beams cut from commercial roof slabs were also tested. A literature survey of the state-of-the-art of reinforced concrete and its fatigue properties was also included. Author

N67-11885*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
DYNAMIC RESPONSE OF BUCKLED STIFFENED PANELS TYPICAL OF S-II STAGE FORWARD SKIRT UNDER ACOUSTIC LOADS Interim Report

C. L. Amba-Rao Mar. 1966 18 p refs Prepared for Brown Eng. Co.
(Contract NAS8-20073)
(NASA-CR-79532; WR-66-19) CFSTI: HC $1.00/MF $0.50
CSCL 20K

This report deals with the prediction of the response (the maximum deflection and maximum stresses) of a stiffened sheet, under compressive loads in the direction of the stiffeners—in the post buckling stage—when subjected to normal acoustic loadings. The buckled sheet between a set of stiffeners is replaced by an equivalent uniform orthotropic plate; the differential equation of motion under an acoustic load is solved exactly within the limitations of the small deflection theory of plates. The work is not complete. The evaluation of the numerical results is yet to be done; however, the groundwork and a formal solution are presented. Author

N67-11686*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
TRANSFER MATRICES AND STIFFNESS MATRICES FOR UNIFORM BEAMS
Robert W. White Nov. 1965 38 p
(Contract NAS8-5384)
(NASA-CR-79533; WR-65-31) CFSTI: HC $2.00/MF $0.50
CSCL 20K

Transfer matrices and stiffness matrices are developed for uniform beams in a steady state vibration at an arbitrary frequency. Assumptions of small bending deflection theory are used. Effects of shear deformation, rotary inertia, and cross-sectional warping are neglected. The following matrices are presented: beam transfer and stiffness matrices without intermediate loads, beam transfer and stiffness matrices for intermediate concentrated force and couple, beam transfer matrix for several intermediate concentrated forces and moments, and beam transfer matrix for continuous applied force and moment distribution. Author

N67-11692*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
DYNAMIC RESPONSE OF BUCKLED STIFFENED PANELS TYPICAL OF S-II STAGE FORWARD SKIRT UNDER ACOUSTIC LOADS Final Report
C. L. Amba-Rao Jun. 1966 61 p refs Prepared for Brown Eng. Co.
(Contract NAS8-20073)
(NASA-CR-79536; WR-66-36) CFSTI: HC $3.00/MF $0.75
CSCL 20K

A convenient method is presented to analyze the problem of the buckled panel, typical of S-II stage forward skirt, under acoustic loads. The total response (deflection) w consists of two components, the static and the dynamic, and superposition in a modified form is valid. The static component of the displacement of the deflection surface in the postbuckled state is calculated, using von Kármán equations, and Galerkin method. The dynamic component of response is calculated formally, utilizing the concept of equivalent fictitious uniformly thick anisotropic plates for small vibrations due to acoustic loadings. Having obtained w, the method of analysis to obtain the principal strains, is formulated. Author

N67-11730*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
ANALYSIS OF GENERAL STRUCTURAL NETWORKS BY MATRIX METHODS
R. W. White Nov. 1965 30 p
(Contract NAS8-5384)
(NASA-CR-79507; WR-65-30) CFSTI: HC $2.00/MF $0.50
CSCL 20K

An analysis for a complicated structural system is presented, using the concepts and analogies of the corresponding electrical system. Any complex system, electrical or mechanical, can be broken down into a series of simple systems and connected together, not violating the equilibrium or compatibility conditions. Transfer matrix analysis is a computer oriented convenient method for complex systems. Author

N67-11754# SAAB Aircraft Co., Linkoping (Sweden).
A METHOD FOR PRELIMINARY ESTIMATION OF FATIGUE STRENGTH IN AIRCRAFT PRIMARY STRUCTURES
Sven Erik Larsson May 1965 48 p refs
(SAAB-TN-57) CFSTI: HC $2.00/MF $0.50

A systematic fatigue strength calculation, based on a number of load spectra and on linear cumulative damage theory, has been made for 12 different skin elements, most of them riveted joints. Information relating to fatigue strength, obtained in constant amplitude tests, for these structural elements was taken from various sources. Author

N67-11911# Aeronautical Research Labs., Melbourne (Australia).
THE BUCKLING OF A RECTANGULAR PLATE UNDER COMBINED BIAXIAL COMPRESSION AND BENDING AND SHEAR
K. I. Mc Kenzie Jan. 1965 39 p refs
(ARL/SM-301) CFSTI: HC $2.00/MF $0.50

An approximate variational method is used to analyze the buckling of a rectangular plate of arbitrary side ratio under a combination of longitudinal and transverse compression, bending about an axis perpendicular to the plane of the plate, and shear. The bending is applied to the pair of sides which are assumed to be simply supported, while the other two sides are supported by edge members of arbitrary torsional and flexural stiffnesses. Derivation of the model is detailed, and the solution is obtained by holding the strain energy value to a minimum. Results are graphed to represent interaction curves for side ratios 1, 2, and 3 with boundary conditions of simple support, rigid clamping, and the intermediate situation in each instance. The range illustrated includes most aeronautical applications and is adaptable to automatic computation. M.W.R.

N67-11926# Naval Research Lab., Washington, D. C.
MECHANICAL IMPEDANCE AND MOBILITY CONCEPTS
G. J. O'Hara 29 Jul. 1966 14 p refs
(NRL-6406; AD-638206) CFSTI: HC $1.00/MF $0.50

The purpose of the report is to discuss fundamental concepts involved in mechanical impedance and mobility. The equations used in the formulation of the concepts are examined as to meaning and content. It is demonstrated for any prescribed structure that every possible observed mobility element is independent of the number and location of the other measurement points and that every possible observed mechanical impedance element is not. The effects upon the mobility and impedance arrays are examined for simple expansions and contractions of the tensor. Since mobility is not affected by changes in the number of observation points, remeasurement is not required at the observation points that are retained during expansion or contraction of the tensor; but since any changes in the observation points for impedance measurements requires changes in the blocking forces, the observation points that are retained are affected. An undamped lumped parameter system (a three-mass system on a rigid base and constrained to unidirectional motion) serves to illustrate the effects on the tensor elements of impedance or of mobility of the choice of the number and location of measurement points. Author (TAB)

N67-11948*# Aeronutronic, Newport Beach, Calif.
ANALYSES OF COMPOSITE STRUCTURES
Stephen W. Tsai, Donald F. Adams, and Douglas R. Doner Washington, NASA, Nov. 1966 233 p refs
(Contract NAS7-216)
(NASA-CR-620) CFSTI: HC $3.75/MF $1.25 CSCL 20K

The stiffness and strength analyses of composite materials previously presented have been reviewed and extended to cross-ply and helical-wound cylinders, as well as flat laminates. Consideration has been given to the composite behavior after initial yielding.

including the influence of filament crossovers in helical-wound cylinders. Theoretical results were compared with experimental data obtained using glass-epoxy composites. Complete digital computer programs, developed in conjunction with the strength analyses of flat laminates and laminated composite cylinders, and the investigation of stress distributions in the fibers and matrix of a composite subjected to either longitudinal shear or transverse normal loading, are presented, in Appendices A, B, and C. Author

N67-11950*# Martin Co., Baltimore, Md.
RESEARCH STUDY TO PROVIDE CONCEPTS OF PANEL ATTACHMENT MECHANISMS SUITABLE FOR REFURBISHABLE PANEL APPLICATION
R. E. Rieckmann Washington, NASA, Nov. 1966 86 p refs
(Contract NAS1-5253)
(NASA-CR-640) CFSTI: HC $2.50/MF $0.75 CSCL 20K

A study has been made to select the best attachment mechanism concept for use in the refurbishable heat shield system. The selected system was an ablator bonded to a phenolic/glass honeycomb substrate panel which was supported off the primary vehicle by phenolic/glass tapered cylindrical cups. The actual refurbishable panel tie is accomplished by the use of lock nuts which are put on aluminum stud fittings located on the primary vehicle shell. Insulation mats are installed between the vehicle and substrate panel. After selecting the attachment concept to be used, a detail structural analysis was made for three representative areas on an HL-10 manned lifting entry vehicle. The three areas were a leading edge section, a bottom section, and a crown section of the vehicle. Critical thermostructural conditions were determined and a digital analysis performed to determine aerodynamic and thermal substrate panel and standoff member stresses and deflections. All of the structural problem areas encountered can be minimized utilizing conventional engineering approaches. Author

N67-11955*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF RELATING MODAL DAMPING TO LOCAL DAMPERS IN LUMPED PARAMETER SYSTEMS
Harry J. Koenig and Daniel I. Drain Washington, NASA, Dec. 1966 32 p refs
(NASA-TN-D-3637) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The longitudinal dynamic characteristics of a linear structure may be approximated by a lumped-parameter model, which usually includes only the stiffness and mass distribution of the system. In general, the effect of damping is not included as a lumped parameter but is treated as an overall or modal characteristic superimposed on the results of the model. This report investigates the relation between the modal damping characteristics and the individual section dampers of a lumped-parameter system that could model a launch vehicle for longitudinal motion. The analysis presented shows that, for the typical damping range of launch vehicles, an approximately linear relation exists between local and modal damping. This linearity allows the determination of either local or modal damping from known values of the other as well as a method of correcting test stand data for the support system damping effects. Also, it can furnish insight into the relative effectiveness of each local damper on the modal damping at each resonant frequency. Two examples of the use of the analysis are included herein as well as a FORTRAN IV computer program suitable for calculations of the damping relations in lumped models up to 10 sections in size. Author

N67-11973# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugzeugbau.
STRENGTH BEHAVIOUR OF OVERLAPPED METAL BONDED JOINTS UNDER FATIGUE LOADING AT ROOM TEMPERATURE AND 100°C [FESTIGKEITSVERHALTEN VON UEBERLAPPTEN METALLKLEBUNGEN UNTER SCHWINGENDER BEANSPRUCHUNG BEI RAUMTEMPERATUR UND BEI + 100°C]
W. Althof 25 May 1966 43 p refs In GERMAN; ENGLISH summary Supported by the Work Community of Ind. Rés.
(DLR-FB-66-47) CFSTI: HC $2.00/MF $0.50

Single lap joints of aluminum alloys and stainless steel bonded with an epoxy-phenol adhesive have been subjected to fatigue loading at +20°C and +100°C. The effect of the overlap length and of the adherend material on the fatigue strength has been investigated. Furthermore, SMITH-diagrams for bonds with different overlap lengths were plotted. Author

N67-11996# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
USE OF TURBULENCE AS A SOURCE OF EXCITATION DURING FLUTTER FLIGHT TESTS [UTILISATION DE LA TURBULENCE COMME SOURCE D'EXCITATION LORS D'ESSAIS EN VOL DE FLOTTEMENT]
Gabriel Coupry and Gérard Piazzoli 1966 26 p refs In FRENCH; ENGLISH summary Presented at the 5th Congr. of the Intern. Council of the Aeron. Sci., London, 12–16 Sep. 1966
(TP-362(1966)) CFSTI: HC $2.00/MF $0.50

After a critical survey of the classical techniques (pulse and harmonic technique) used in flight flutter test, the authors make clear the interest of natural turbulent excitation, with emphasis on the limitation of such a technique. Three methods are proposed which provide the measurement of the damping coefficient of the natural modes from the random response of the structure. In the first methods, the damping coefficient is measured with the help of cross-correlation function; in the second one, the measurement is provided by rejection filters. The third method is based on counting the number of zero crossings of the response. For all the three methods, an experimental check is proposed. Author

N67-12027# Forest Products Lab., Madison, Wis.
STRESS DISTRIBUTION IN AN ORTHOTROPIC HALF-PLANE SUBJECTED TO A CONCENTRATED LOAD
A. C. Maki Feb. 1966 12 p refs
(FPL-54)

Mathematical expressions are derived for the stress distribution in wood subjected to a concentrated load. The orthotropic nature of wood was taken into account in the derivation. The analysis was also used to determine the stress distribution in an orthotropic wedge subjected to a concentrated load at its vertex. Author

N67-12048*# Allied Research Associates Inc., Concord, Mass.
PHOTOMECHANICAL INVESTIGATION OF STRUCTURAL BEHAVIOR OF GYROSCOPE COMPONENTS. TASK IV: ANALYSIS OF INITIAL REDESIGN OF AB5–K8 GYROSCOPE
H. Becker, F. F. Bird, P. E. Kyle, R. Papirno, and C. N. Tang Apr. 1966 59 p refs
(Contract NAS8-11294)
(NASA-CR-80060; ARA-284-8) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Theoretical and experimental investigations were conducted on the structure and the materials of the first of several redesigns of the AB5–K8 gyro. Shock and temperature loads were considered, and determination was made of the precision elastic limit (PEL) of the beryllium now being used in the gyro. As a result of the investigations, elementary beam theory was shown to be a reliable procedure for predicting shaft deflections, a simple method of transient heat transfer was shown to have promise in shaft design,

and an efficient fork configuration appeared to be achievable using thin, flat members cantilevered from the cover plate. The PEL of S-100 beryllium was at the low end of the range of properties of standard beryllium metal, below that of the high PEL beryllium (I-400), and far below what might be expected fo steels. Author

N67-12049*# Allied Research Associates, Inc., Concord, Mass.
PHOTOMECHANICAL INVESTIGATION OF STRUCTURAL BEHAVIOR OF GYROSCOPE COMPONENTS. TASK V: MATERIALS AND DESIGN DATA
P. E. Kyle, R. Papirno, C. N. Tang, and H. Becker Sep. 1966 60 p refs
(Contract NAS8-11294)
(NASA-CR-80059; ARA-284-21) CFSTI: HC $3.00/MF $0.75 CSCL 20K

Microplasticity experiments, metallurgical investigations, and fork optimization work carried out to aid in achieving an efficient gyroscope or accelerator cover design for anticipated temperature and inertia fields are described in detail. Microplastic strain data for each of the materials tested are presented in tabular form. Preliminary optical and electron metallographic studies were made on beryllium to establish the value of such studies in explaining the microdeformation behavior of these materials under stress. The studies involved definition of the overall metallographic structure by optical metallography, study of dislocation positions and movement using etch pit techniques and electron metallography, and temperature–humidity corrosion tests. Requirements for the design of fork are mentioned, and design optimization is described. Treatments of metals tested and temperature–humidity test results on beryllium samples are also given. L.E.W.

N67-12051*# Goodyear Aerospace Corp., Akron, Ohio.
PROGRAM FOR THE EVALUATION OF STRUCTURAL REINFORCED PLASTIC MATERIALS AT CRYOGENIC TEMPERATURES Final Report, 1 Jul. 1963–1 Jul. 1966
L. W. Toth, T. J. Boller, I. R. Butcher, A. H. Kariotis, and F. D. Yoder 31 Aug. 1966 239 p refs
(Contract NAS8-11070)
(NASA-CR-80061; GER-12792) CFSTI: HC $6.00/MF $1.25 CSCL 20K

A three-year program of critical assessment and evaluation of procedures, test specimens, and test techniques for application to structural, reinforced plastic materials at cryogenic temperatures is documented. Basic mechanical and thermal property determinations were investigated throughout the range of 298 to 20°K. A controlling consideration was the development of systematized procedures to yield reliable design data for the prediction of the performance of reinforced plastic materials in this temperature range. The mechanical properties tests at cryogenic temperatures have shown the expected significant increase in strength as the temperature decreases. The magnitude of the ultimate strengths, however, has in certain cases exceeded expectations. Of even greater importance is the fact that the modes and location of the failures of the individual specimens indicated that the ultimate strengths of the materials are being determined by the test specimens and methods employed. The testing program has shown that the properties of fiberglass laminates lend themselves to cryogenic application. Author

N67-12052*# Goodyear Aerospace Corp., Akron, Ohio.
STUDY OF EXPANDABLE, TERMINAL DECELERATORS FOR MARS ATMOSPHERIC ENTRY. VOLUME II: SUPPORTING DATA AND TECHNICAL ANALYSIS
Jay L. Musil 3 Oct. 1966 286 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951153)
(NASA-CR-79496; GER-12842, vol. II) CFSTI: HC $6.00/MF $0.50 CSCL 22B

Aerodynamic characteristics, thermal environment and analytical details, as well as preliminary design, development and testing of expendable, terminal decelerator for application to Mars atmospheric entry are delineated. Also considered are details on: sterilization and materials, decelerator envelope size established by thermal requirements, auxiliary gas-inflation means for the decelerators, and free-flight test simulation. Further technical details are given on weight calculations for several fabric decelerators for a Mars entry capsule. Appendixed is a digital computer program for simulating the motion of re-entry vehicles with either rigidly erected or tethered deceleratory systems. R.U.

N67-12058*# Battelle Memorial Inst., Columbus, Ohio.
DAMPING CAPACITY OF MATERIALS. VOLUME I
Robert E. Maringer Redstone Arsenal, Ala., Redstone Sci. Inform. Center, 3 Jan. 1966 390 p refs Jointly Supported by NASA
(Contract DA-01-021-AMC-11706(Z))
(NASA-CR-80143; RSIC-508) CFSTI: HC $7.00/MF $1.75 CSCL 20K

A brief introduction to the field of damping capacity in materials and an extensive, annotated bibliography is presented. The introductory material includes the fundamentals of damping, general methods of measuring internal friction of damping capacity, and some representative damping properties. The bibliography contains over 2300 references to pertinent literature published from 1955 through 1965, and is cross-indexed by both author and subject. In addition, computer searches were run by Defense Documentation Center and by the National Aeronautics and Space Administration for location of pertinent literature published during the last four years. Articles, books, and papers are listed alphabetically by the author's last name. (Where there is more than one author, the alphabetical listing is by last name of first author.) Reports are listed alphabetically by the corporate author, that is, by the corporation, company, or agency from which the report originated. Author

N67-12060*# Battelle Memorial Inst., Columbus, Ohio.
DAMPING CAPACITY OF MATERIALS. VOLUME II
Robert E. Maringer Redstone Arsenal, Ala., Redstone Sci. Inform. Center, 3 Jan. 1966 391 p refs Jointly Supported by NASA
(Contract DA-01-021-AMC-11706(Z))
(NASA-CR-80144; RSIC-508) CFSTI: HC $7.00/MF $1.75 CSCL 20K

An extensive, annotated bibliography on materials damping accompanied by a short introduction to damping capacity in metals, is presented. Information on the fundamentals of damping, general methods of measuring internal friction or damping capacity, and some representative damping properties are supplied. R.U.

N67-12063*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N. Y.
EXPERIMENTAL DETERMINATION OF SYSTEM PARAMETERS FOR THIN-WALLED CYLINDERS Third Annual Summary Report, 1 Jul. 1965–31 Aug. 1966
Robert S. Levy and Marvin J. Forray 31 Aug. 1966 101 p refs
(Contract NAS8-11514)
(NASA-CR-79758; FHR-1117-20) CFSTI: HC $4.00/MF $0.75 CSCL 20K

Tests and analyses were conducted on the problem of predicting the natural frequencies and mode shapes of weighted, pressurized cylinders without stringers. A digital computer program capable of computing the resonant frequencies of pressurized cylinders with frames and an attached mass was developed. Used in the experiments was a specimen consisting of an 0.020 gage aluminum cylinder, 36 inches in diameter, 36 inches long, with heavy frames spaced at 6 inches. Mechanical impedance measurements were made with an impedance head that had a

weight downstream of the force gage of only 0.35 gram. The mass cancellation circuitry was further investigated. The sensor modal that was used to measure cylinder motion during acoustic noise excitation permitted measurement of the dynamic response of a truly unweighted cylinder. Shell modes higher than the fundamental were identified and measured on a weighted cylinder. Cylinder excitation using the vibration shaker, acoustic horn, and the mallet thump gave consistent values of the fundamental resonant frequency. K.W.

N67-12097*# Aerojet-General Corp., Azusa, Calif. Computing Sciences Div.

COMPUTER PROGRAM FOR THE ANALYSIS OF FILAMENT-REINFORCED METAL-SHELL PRESSURE VESSELS

F. J. Darms et al May 1966 410 p refs

(Contract NAS3-6292)

(NASA-CR-72124) CFSTI: HC $4.59/MF $2.00 CSCL 20K

Purpose of the program is to perform calculations for the design and structural analysis of pressure vessels fabricated from filament-reinforced metal shells. The program is to be used in connection with a number of design and analysis calculations, among which the following are presented: (1) solution of force equilibrium and strain compatibility equations at the equator of the heads; (2) calculation of parameters describing head contours and the cylindrical section; (3) determination of stresses and strains at all points on the head contour and in the cylindrical section resulting from various combinations of pressures and temperatures; and (4) computation of rating properties of the entire vessel and its components. The program is written in FORTRAN IV for the IBM 7094-2 digital computer. Program routine and subroutines are described, input and output informations are discussed, and sample problems are included. K.W.

N67-12109*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COMPARISON OF ENTRY-BODY SHAPES FOR TOTAL EQUILIBRIUM RADIATION UNDER MARS ENTRY CONDITIONS

H. J. Stumpf *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 28–31 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Summary data are presented on an experimental program being conducted to measure and compare the total (over the whole body) equilibrium shock layer radiative heat transfer for three entry body shapes in a simulated Mars atmosphere. Simulated flight conditions are listed, similar to those expected to be encountered in typical hyperbolic Mars entry trajectories where maximum stagnation point convective or radiative heat transfer occur. The use of a ballistic range, a shock tube, and a shock tunnel for measuring total radiation is proposed; the relative advantages and disadvantages of each method is assessed. Figures depict the blunt cone, modified Apollo, and tension shell entry body shapes. Preliminary data from the ballistic range tests indicate that the modified Apollo shape is subject to much higher equilibrium shock layer radiation than either the blunt cone or tension shell. M.G.J.

N67-12111*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ENVIRONMENTAL AND PHYSICAL EFFECTS ON THE RESPONSE OF BALSA WOOD AS AN ENERGY DISSIPATOR

A. C. Knoell *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 33–34 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

Certain conclusions are presented, resulting from a program conducted to provide engineering data on the design relations establishing the effects of temperature, pressure, moisture content, and density on the energy dissipating capabilities of balsa wood. Among the results listed are: (1) Specific energy dissipation and crushing stress of the balsa wood increase with decreasing moisture content, decreasing temperature, and increasing density. (2) Environmental pressure has little effect on response. (3) Thickness efficiency is insensitive to physical and environmental variables. (4) Crushing stress varies in magnitude during static crushing. (5) Frequency of balsa wood splitting increases with increasing density. (6) Specimen response varied as much as ±15% of the average response of specimens tested under the same physical and environmental conditions. M.G.J.

N67-12112*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CONTINUING DEVELOPMENT OF PHENOLIC HONEYCOMB AS AN ENERGY DISSIPATOR

A. C. Knoell *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 34–35 (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

A development program designed to improve the energy dissipating characteristics of phenolic honeycomb is reported. Its objectives are listed as an effort to improve response of the material under high velocity (500 ft/sec) impact; to determine its response after sterilization (3 cycles at 300° F for 36 hours in dry N_2); and to establish feasibility of improving double curvature capability through use of nonhexagonal cell configurations. Preliminary results indicate that use of a thin dip technique for resin buildup on the honeycomb glass cloth core is apparently sufficient to preclude previous failures of the honeycomb at the node bond lines during crushing. M.G.J.

N67-12174*# Goodyear Aerospace Corp., Akron, Ohio.

STUDY OF EXPANDABLE, TERMINAL DECELERATORS FOR MARS ATMOSPHERE ENTRY Interim Summary Report, Dec. 1965–Jun. 1966

Jay L. Musil 22 Jul. 1966 38 p refs Prepared for JPL

(Contracts NAS7-100; JPL-951153)

(NASA-CR-80127; GER-12691, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Progress is reported from a parametric study conducted to determine the suitability of expandable terminal decelerators for a Mars-lander capsule. The study is based on the analytical formulation of the effects associated with the model environments of Mars and specified capsule entry conditions. These effects and conditions govern the requirements for the engineering applications of expandable decelerator devices. Consideration is given to basic decelerator configurations, Mars entry trajectories, initial stage decelerator configurations, and fundamental engineering design requirements for intial-stage, expandable decelerators that must stabilize and retard the Mars-lander capsule. Areas in which additional investigations are recommended are also discussed. A.G.O.

N67-12196# David Taylor Model Basin, Washington, D. C.

THE BUCKLING STRENGTH OF FABRICATED HY-80 STEEL SPHERICAL SHELLS Final Report

Thomas J. Kiernan and Kanehiro Nishida Jul. 1966 153 p refs

(DTMB-1721; AD-637791) CFSTI: HC $5.00/MF $1.00

Hydrostatic tests were conducted on forty fabricated HY-80 steel hemispheres and ellipsoids to study the effects of initial imperfections, residual stresses, and penetrations on the elastic behavior and collapse strength. By using critical local geometries rather than nominal geometries, definite patterns in test results are shown. The importance of accurate and detailed determination of local geometries is demonstrated. (Author) TAB

N67-12227*# Benson (Robert W.) and Associates, Inc., Nashville, Tenn.

DEVELOPMENT OF NON-DESTRUCTIVE METHODS FOR DETERMINING RESIDUAL STRESS AND FATIGUE DAMAGE IN METALS Annual Report, 9 Jul. 1965–8 Jul. 1966

R. W. Benson et al 30 Jun. 1966 66 p ref
(Contract NAS8-20208)
(NASA-CR-79304; MPR-12) CFSTI: HC $3.00/MF $0.75 CSCL 20K

The measurement of residual stress in structures is necessary to assure satisfactory performance from the material selected. Premature failure of a structure is often caused by the lack of knowledge of residual stresses since the design can only account for the superimposed loads due to external forces. The present program has been concerned with the development of nondestructive methods of stress analysis suitable for field application on actual metallic structures. Methods of providing a measurement due to uniaxial loads and due to bending moments are described in this report. Experimental data is given showing the relationship between ultrasonic wave propagation and actual stresses. The techniques are demonstrated under laboratory conditions with practical stress distributions that can be encountered. Additional effort was concerned with the detection of damage to metals by both fatigue and stress corrosion. The measurements included ultrasonic wave attenuation, electromagnetic resistivity and mechanical internal friction. Author

N67-12236*# North American Aviation, Inc., Downey, Calif. Structures and Dynamics Dept.
MASS LOADING EFFECTS ON LOCALIZED VIBRATORY ENVIRONMENTS OF ROCKET VEHICLES Technical Summary Report, 30 Jun. 1965–31 Jul. 1966
S. Y. Lee and S. S. Tang 20 Jul. 1966 274 p refs
(Contract NAS8-20019)
(NASA-CR-79512; SID-66-1201) CFSTI: HC $6.00/MF $1.50 CSCL 20K

Mass-loading and mass-coupling effects on dynamic characteristics of localized rocket vehicle structures were studied analytically and experimentally. Beams and plates loaded with various masses and brackets were investigated. Solutions were obtained on free-vibration characteristics, transmissibility, and forced response. A specially built electromagnetic induction shaker, in addition to conventional vibration and acoustic test equipment, was employed to produce excitations including edge motions, concentrated force, and distributed force in the form of sinusoidal and random input. The analytical solutions agree closely with experimental results. Author

N67-12263*# Denver Research Inst., Colo.
MATRIX SOLUTION OF SHELLS OF ARBITRARY SHAPE SUBJECTED TO ARBITRARY DYNAMIC LOADING Final Report
Rudolph Szilard Aug. 1966 82 p refs
(Grant NsG-518; Proj. DRI-626-6607-F)
(NASA-CR-80114; Rept.-626-6607-F) CFSTI: HC $3.00/MF $0.75 CSCL 20K

After a brief review of the state-of-the-art, the problematics pertinent to a discrete element approach to dynamic shell problems are discussed. In the derivation of the discrete element properties using unit displacement theorem, the stiffness coefficients of a square flat shell element are developed by solving the differential equations of the theory of elasticity by finite difference methods. Symmetry in the stiffness matrix has been achieved via virtual work of the edge forces. Monotonic convergence of the solution is assured by satisfying the compatibility requirements of stresses and displacements within the element as well as along the adjoining edges. The basically different convergence criteria of small vs. large element solutions are treated. Expressing the arbitrary (in space and time) loads by Fourier series the differential equations of motions are transformed into coupled algebraic equations well suited for computer solution. The frequencies of the free vibration are obtained as eigenvalue solutions of the dynamical matrix. The accuracy of the method is checked against known analytical solutions. The procedure for automation of the solution is outlined along with the areas of future research. Author

N67-12293*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ROCKET-BLAST-RESISTANT MATERIALS: ROCKET ENGINE BLAST TEST ON EXPEDIENT SURFACING MATERIALS, MARCH–AUGUST 1962
Grady W. Leese Apr. 1966 31 p *Its* Misc. Paper no. 4-804
(Rept.-1; AD-633264) CFSTI: HC $2.00/MF $0.50

Blasts tests with a 500-lb-thrust rocket engine were conducted on (a) ceramic-coated aluminum blast panels, (b) steel panels, (c) plastic panels, and (d) nylon membrane with and without a heat-resistant coating to determine the capabilities of these items to withstand the high temperatures and velocities generated during the firings. Based on results obtained in this investigation, the following conclusions are believed warranted: (a) The steel panels without protective coating will withstand exposure to higher blast temperatures than will the ceramic-coated aluminum panels. (b) The ceramic coating on the aluminum panels and the heat-resistant coating on the nylon membrane greatly increase the capabilities of these items to resist the rocket engine exhaust blasts. (c) The plastic panels sustained considerable damage during exposure for 20 sec to the full-stage blast of the model engine. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants

N67-11201 RAND Corp., Santa Monica, Calif.
PROCEEDINGS OF THE SECOND ALL-SOVIET UNION CONFERENCE ON HEAT AND MASS TRANSFER, VOLUME I
C. Gazley, Jr., J. P. Hartnett, and E. R. G. Eckert, ed Aug. 1966 393 p refs Transl. into ENGLISH from Russian Conf. held in Minsk, May 1964
(Contract AF 49(638)-1700; Proj. RAND)
(R-451-PR, Vol. I; AD-637690) Available from Calif. Univ. Press, Los Angeles: $7.00

Conference papers on heat transfer and frictional resistance in fluids with variable physical properties and in pipes and channels of different shapes, heat transfer and resistance studies in entry sections of pipes and channels, increase of convective heat transfer rate, and unsteady-state convective heat transfer are presented. For individual titles see N67-11201–N67-11234.

N67-11202 RAND Corp., Santa Monica, Calif.
CONVECTIVE HEAT TRANSFER IN A HOMOGENEOUS MEDIUM
B. S. Petukhov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p IX–XV (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The main topics considered in the symposium papers are highlighted: heat transfer and frictional resistance in a liquid or gas, and in tube and channel systems of different geometry; unsteady-state convective heat transfer; hydordynamics and heat transfer in jets; and, increases in the rate of convective heat transfer. Special attention is devoted to: friction resistance with changing physical properties; resistance in turbulent gas flows with high temperature differences; heat transfer in the supercritical region, both in forced turbulent flows in tubes as well as under conditions of free convection; heat transfer data for carbon dioxide, water and ethyl alcohol in the supercritical region; heat transfer and hydraulic resistance in annular channels and in axial flow past tube

bundles; unsteady convective heat transfer in laminar flow; results of investigation of the hydrodynamics and heat transfer in jets, including free jets, cocurrent jets, and also jets propagating along walls. R.Li.

N67-11203 RAND Corp., Santa Monica, Calif.
NEW DATA ON THE PROPERTIES OF TRANSONIC FLOWS
A. A. Gukhman, A. F. Gandel'sman, V. V. Usanov, and G. N. Shorin *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 3–8 refs (see N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

In a transonic flow investigation, results obtained within the framework of a one-dimensional physical model are compared with those obtained theoretically. The local values of the fluid flow resistance coefficient and its computational analog are determined, and the ratio of these quantities is used as the qualitative measure of deviation from the Reynolds analogy. Graphs show the curves of density distribution of the heat flux along the length of the nozzle for different values of the Reynolds number, as well as the distribution of specific heat fluxes along the length. It is concluded that the theoretical values which were obtained on the assumption that the flow is laminar are not in agreement with experimentally obtained data even by order of magnitude. R.Li.

N67-11204 RAND Corp., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER FROM A TUBE WALL TO MONATOMIC, DIATOMIC, AND TRIATOMIC GASES AT LARGE TEMPERATURE GRADIENTS
V. L. Lel'chuk, G. I. Elfimov, and Yu. P. Fedotov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 9–17 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The problem of heat transfer from the wall to a gas is reviewed. An experimental investigation of heat transfer from a tube wall to monatomic, diatomic, and triatomic gases at large temperature gradients was conducted. The recorded data, corrected for the small heat losses, were used to calculate, at different cross sections along the length of the tube, local values of the heat flux density to the gas, the temperature (thermodynamic and stagnation) of the gas and its velocity, the heat transfer coefficient, and the dimensionless groups. The flow variables were calculated from the one-dimensional approach, taking the changes in heat capacity into account. A comparison of the amount of heat transferred to the gas in the entire experimental section with the total electrical energy supplied and with a correction for heat losses showed that the heat balance exceeded 2% only in rare cases. An equation is recommended for the calculation of the dimensionless numbers at the flow temperature. R.Li.

N67-11205 RAND Corp., Santa Monica, Calif.
INVESTIGATION OF HEAT TRANSFER TO ORGANIC LIQUIDS
L. S. Sterman and V. V. Petukhov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 18–25 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The heat transfer coefficients to organic liquids without change in the state of aggregation (phase) are considered. A relationship was proposed for calculation of heat transfer with variable properties of a liquid, for the case of heating of the liquid, and for cooling. A cross-section cut portrays the experimental apparatus consisting of a closed loop with forced liquid circulation. The temperature of the liquid at the inlet and the outlet of the experimental section was measured with chromel-kopel thermocouples at the inlet or outlet of the section, and from the heat balance in the section upstream or downstream of the thermocouple. A comparison of experimental data obtained with values calculated by the equations of various authors is presented. R.Li.

N67-11206 RAND Corp., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER FOR CARBON DIOXIDE IN THE SUPERCRITICAL REGION
E. A. Krasnoshchekov, V. S. Protopopov, Van Fen, and I. V. Kuraeva *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 26–35 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

An experimental section was fabricated from a steel tube and heated electrically as part of a research project to study turbulent heat transfer to heated carbon dioxide in the supercritical state. Carbon dioxide at the inlet and the outlet of the experimental section were recorded by copper-constantan thermocouples, the hot junctions of which were inserted in stainless steel capillary tubes. Local values of the heat flux at the inner surface of the tube were determined from the electric current and the local electrical resistance of the experimental tube. It was found that the nature of the change in the heat transfer coefficient along the length of the tube under certain conditions can be different depending on the magnitude of the heat load and the value of the liquid flow rate; however, the dependence of the heat transfer coefficient on the flow rate under specified conditions remains the same. A plot graphically shows the peculiar nature of the change in wall temperature over the length of the tube at a given heat flux density. R.Li.

N67-11207 RAND Corp., Santa Monica, Calif.
CONVECTIVE HEAT TRANSFER TO CARBON DIOXIDE IN THE SUPERCRITICAL REGION
E. N. Dubrovina and Vj P. Skripov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 36–45 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Experiments on heat transfer in the neighborhood of the critical point are reviewed. Carbon dioxide was selected for heat transfer studies in the supercritical region; the experiments and apparatus are described. The dependence of the heat transfer coefficient on pressure was determined. The heat flux density and the heat transfer coefficient were calculated, and the voltage drop measured with a potentiometer. The formula for calculating the temperature difference was derived. Visual observations were made of the state of the carbon dioxide in the middle section of the chamber, but the convective flows were observed only under conditions of maximum heat transfer coefficient. Experimental data reported for very large intervals of temperature and pressure were recalculated, and are presented in tabular form. R.Li.

N67-11208 RAND Corp., Santa Monica, Calif.
THEORETICAL CALCULATION OF HEAT TRANSFER AND FRICTION RESISTANCE FOR SUPERCRITICAL CARBON DIOXIDE
V. N. Popov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 46–56 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

For use in calculating heat transfer and friction resistance, an analytical expression for the Nusselt number obtained for steady-state axisymmetric turbulent flow of an incompressible liquid in a tube, with variable physical properties of the liquid, was derived. Results of calculation of heat transfer and friction resistance for carbon dioxide are reported. Comparisons of these results with experimental data cited in the literature review are plotted. R.Li.

N67-11209 RAND Corp., Santa Monica, Calif.
INVESTIGATION OF THE COOLING PROPERTIES OF ETHYL ALCOHOL AT ABSOLUTE PRESSURE OF UP TO 800 ATM

I. T. Alad'yev, P. I. Povarnin, L. I. Malkina, and E. Yu. Merkel' *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 57–60 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

In connection with the cooling properties of ethyl alcohol, the problem of pseudo-boiling is explored. It is assumed that the agitation of the boundary layer and the accompanying increase in the heat transfer rate always results from the formation of a new liquid phase with a lower density. This new phase, under subcritical conditions, consists of vapor in the form of bubbles and the process is called boiling. Examples are given for the supercritical state, in which analogous phenomena are caused by different processes. For the experiments reported, pseudo-boiling was absent at pressures of 250 and 300 atm(abs) for all flow velocities, although a certain improvement in the heat transfer was noted in a series of experiments at a pressure of 350 atm(abs). The characteristic sound of this phenomenon (singing), reported in the literature reviewed, was not observed. R.Li.

N67-11210 RAND Corp., Santa Monica, Calif.

HIGH-FREQUENCY INDUCTION HEATING OF LIQUID-METAL HEAT-TRANSFER AGENTS

D. M. Kalachev, I. S. Kudryavtsev, B. L. Paskar', and I. I. Yakubovich *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 61–64 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The induction heating method tested in laboratory-type circuits using a heavy metal alloy and a light alkaline metal is described. The following quantities were measured: the power at the generator bus bar, the generator voltage and current, the temperature of the metal and of the cooling medium at the inlet and outlet of the induction heater, and the flow rate of the metal and of the cooling medium. The electric parameters, temperatures, and flow rates measured in the experiments were used to determine the quantity of heat received by the metal in the heater, the output of the high frequency generator, and the heat lost in the induction heater. It was shown that the induction heating method has the advantage of a simple design of the heater proper (tube, circuit and induction heater), of smoothly adjustable output and stable heat generation, and of the fact that the heat emission is independent of the temperature of the heated medium. The induction method for heating moving liquid metals is recommended for use in installations using liquid-metal heat-transfer agents. R.Li.

N67-11211 RAND Corp., Santa Monica, Calif.

HEAT TRANSFER FOR GAS FLOW IN ANNULAR TUBES

B. S. Petukhov and L. I. Royzen *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 67–79 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

An experimental investigation of heat transfer in turbulent flow of air in annular channels over a range from 0.07 to 0.84 was conducted to assess the geometrical effect of the ratio of the inside and outside diameters of the tubes. Results of a theoretical calculation of the adiabatic wall temperatures are shown; the difference between theory and experiment does not exceed 10%. Equations derived permit calculation of heat transfer and adiabatic wall temperatures with one-sided heating (inner or outer). In the case of heat transfer through both walls at an arbitrary ratio of heat flux densities at the walls, the heat transfer coefficients at the inner and outer walls are calculated. R.Li.

N67-11212 RAND Corp., Santa Monica, Calif.

HEAT TRANSFER AND HYDRAULIC RESISTANCE IN ANNULAR CHANNELS WITH SMOOTH AND ROUGH HEAT-TRANSFER SURFACES

P. I. Puchkov and O. S. Vinogradov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, vol. I Aug. 1966 p 80–96 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Special experiments were carried out on heat transfer in smooth annular channels to obtain additional data and geometrical characteristics on hydraulic resistance in annular channels. The method of increasing heat transfer by roughening the surfaces is mentioned. Graphs, experimental apparatus, and details on the test section are presented for several types of rough channels. The effects of the shape of the roughness elements at constant geometrical dimensions have been indicated. It has been shown that it is impossible to derive an expression for the effect of the spacing or concentration of the roughness elements since at a constant height the effect of the spacing depends on the shape of the elements. R.Li.

N67-11213 RAND Corp., Santa Monica, Calif.

EXPERIMENTAL STUDY OF HEAT TRANSFER AT THE END WALL OF THE INTER-BLADE SPACE

L. M. Zysina-Molozhen and N. B. Uskov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 97–107 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The results of experimental determination of the average heat transfer coefficient for the problem of heat transfer at the end wall of inter-blade space are reported. The heat transfer coefficient was calculated on the basis of experimental results obtained by using three types of turbine shapes at different temperatures and velocities of the gas at the inlet to the network, different gas-inflow angles, different relative pitches, and different values of the temperature factor. R.Li.

N67-11215 RAND Corp., Santa Monica, Calif.

CALCULATION OF CONVECTIVE HEAT TRANSFER FOR AN INCOMPRESSIBLE LIQUID IN COMPLEX-CONFIGURATION CHANNELS

B. P. Ustimenko, K. A. Zhurgambaev, and D. A. Nusupbekova *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 124–143 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The results of a calculation of heat transfer and resistance in the laminar flow of an incompressible viscous liquid in flat, rectangular, and curvilinear channels with different ratios of the heat fluxes at the walls of the channels are evaluated. Exact analytical solutions to the problems of laminar heat transfer, approximate calculations of turbulent convective heat transfer in channels, obtained with the aid of a hydrodynamic integrator, are also reported. Equations are derived for the velocity and resistance profiles in a flat curvilinear channel, and for heat transfer in a circular laminar flow. A mathematical solution is provided for the problem of turbulent convective heat transfer with the aid of a hydraulic integrator. R.Li.

N67-11217 RAND Corp., Santa Monica, Calif.

THE HYDRODYNAMICS OF A NONISOTHERMAL LUBRICANT LAYER

M. E. Podol'skiy *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 151–163 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

For application to sliding thrust bearings, an approximate solution is carried out for the hydrodynamic and energy-balance equations, taking into account the change in the viscosity along the length and the thickness of the layer. The boundary conditions for the temperature were selected by analyzing the propagation of heat in a rod. A more detailed study was made of the flow of the lubricant between parallel friction surfaces. The formulas obtained

show that the friction surfaces are attracted to each other due to the temperature dependence of the viscosity. Among other results, it was found that the nonisothermal flow of oil in a gap of constant thickness, under the specified conditions, leads to the emergence of forces which draw the friction surfaces together. R.Li.

N67-11218 RAND Corp., Santa Monica, Calif.
HYDRODYNAMICS AND HEAT TRANSFER OF ROTATING FLOW BETWEEN TWO COAXIAL CYLINDERS
V. N. Zmeikov and B. P. Ustimenko *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 164–179 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Detailed data are given on the distribution of flow velocities, temperature, and pulsation characteristics, as a basis for understanding the physical mechanism of the process and for constructing a rational method of calculating heat transfer and resistance. Based on the hydrodynamic theory, a scheme is proposed for calculating heat transfer, and equations are derived to describe the velocity profiles and the resistance coefficient. Three cases are considered: flow hydrodynamics in an annular channel with an inner rotating cylinder; heat transfer in flow in an annular channel with an inner rotating cylinder; and turbulent structure of the flow in an annular channel with an inner rotating cylinder. M.G.J.

N67-11219 RAND Corp., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF FRICTION AND HEAT TRANSFER IN GAS FLOW IN A DIFFUSION CHANNEL WITH COOLED WALLS AND IN THE PRESENCE OF COMBUSTION
P. N. Romanenko and A. N. Oblivin *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 180–189 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Both convective and radiant heat transfer are considered simultaneously in experiments conducted on the problem of heat transfer and friction in the turbulent flow of gases during the combustion of the fuel elements. The apparatus consisted of an open aerodynamic pulsation tube; experiments were carried out under six sets of conditions, each characterized by a definite temperature and gas velocity at the inlet to the experiment section. Measurements were made of the temperature and velocity distributions over the cross section of the flow, the static pressure at each cross section, the flow rate of the cooling water and its temperature at the inlet and outlet of five cross sections of the experimental section, and of the wall temperature of the channel. The composition of the combustion products was determined by gas analysis. Experimental data obtained from the integral properties of the turbulent boundary layer, the friction coefficients, and the heat flux at the wall were correlated to determine empirical relationships between these quantities. The effect of the temperature factor on friction and heat transfer was also analyzed. M.G.J.

N67-11220 RAND Corp., Santa Monica, Calif.
HEAT TRANSFER IN THE HYDRODYNAMIC INLET REGION OF A ROUND TUBE WITH LAMINAR FLOW
B. S. Petukhov and Chzhen-Yun Chzhen *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 193–204 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Using the approximate boundary layer methods, a solution to the problem of heat transfer in the hydrodynamic initial section of a round tube is described. The problem is solved taking into account the following assumptions: (1) Both the flow and heat transfer are steady-state. (2) The fluid is incompressible, and its physical properties are constant. (3) Change in the heat flux due to heat conduction along the axis, and frictional heating, are negligibly small. (4) The temperature and the velocity of the fluid are distributed uniformly in the initial cross section, and the velocity vector coincides with the axis of the tube. (5) A uniform heat flux is maintained on the outer surface of the tube wall. R.Li.

N67-11221 RAND Corp., Santa Monica, Calif.
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER AND HYDRODYNAMIC RESISTANCE IN THE INLET SECTION OF A FLAT CHANNEL WITH LAMINAR FLOW OF A VISCOUS FLUID
A. A. Zukauskas and I. I. Ziugzda *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 205–210 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Local heat transfer and hydrodynamic resistance in different flows of a liquid, within a wide range of physical properties are investigated. An equation is derived for determining the hydrodynamic resistance through measurement of the static pressure drop before and after the channel. Data for local heat transfer on a plate are shown on a curve, and it is seen that the experimental data for heat transfer in the inlet section approach asymptotically those for heat transfer on a plate. Using these results, a generalized formula is obtained to express the local heat transfer in the inlet section of a flat channel. R.Li.

N67-11222 RAND Corp., Santa Monica, Calif.
TURBULENT NONISOTHERMAL FLOW OF A VISCOUS COMPRESSIBLE GAS IN THE STARTING LENGTH OF AXISYMMETRIC AND FLAT EXPANDING CHANNELS WITH ZERO PRESSURE GRADIENT
E. E. Solodkin and A. S. Ginevskii *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 211–227 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

An investigation was made of nonisothermal flow of a viscous compressible gas in the entry sections of axisymmetric and flat channels with a zero pressure gradient, at subsonic flow velocities, over a wide range of change in the temperature ratio. Mathematical expressions are given for the flow in expanding channels with round and flat cross sections having a zero pressure gradient. Also included are formulas for determining the coefficients of total pressure drop for the flow of a viscous compressible gas in the initial portions of flat and axisymmetric channels without and with heat transfer, with a turbulent mixing Prandtl number different from unity. R.Li.

N67-11223# RAND Corp., Santa Monica, Calif.
HEAT TRANSFER IN THE INLET PORTION OF A TUBE WITH TURBULENT FLOW
P. N. Romanenko and N. V. Krylova *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 228–239 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The local values of the heat transfer coefficient in the initial portion of a tube are determined by the development of the thermal and dynamic boundary layers. New experimental material was obtained on the influence of inlet conditions on heat transfer in the initial portion of a cooled tube, with turbulent motion of the heated air. Correlation of the experimental data on the basis of the theory of local similarity permitted the proposal of a method for calculation of the local values of the heat transfer coefficient in the initial portion, taking inlet conditions into account. The data obtained are indispensable for calculation of heat transfer by the proposed method. A comparison of the reported experimental data on heat transfer in the initial portion of a tube having different inlet conditions, with data reported by other investigators, shows good agreement of the values compared. R.Li.

N67-11224 RAND Corp., Santa Monica, Calif.
INCREASING THE RATE OF HEAT TRANSFER IN A ROUND AIR-COOLED TUBE
A. V. Ivanova *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 243–250 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

To increase the rate of heat transfer through an increase in velocity, a twisting motion of the fluid medium was achieved by the vanes of whirling devices located directly at the inlet of a tube. Since an increase in the heat transfer rate is connected with the consumption of power, not only for pumping the heat transfer medium through the tube but for overcoming the resistance of the whirling devices themselves, the most advantageous profile and number of vanes was determined for each given angle of twisting. Analytical data show that with an identical expenditure of energy, an increase in the angle of twisting increases the efficiency of the apparatus. It is therefore considered that a twisted flow considerably increases the heat-transfer rate due to an increase in the velocity of the medium flowing past the heat generating surface, and that whirling devices of a similar type are, by their construction, applicable to tubes of small diameter, and to a closely packed arrangement of such tubes in the system. R.Li.

N67-11225 RAND Corp., Santa Monica, Calif.
INVESTIGATION OF THE FLUID DYNAMICS AND HEAT TRANSFER IN A CHANNEL WITH TURBULIZERS ON THE HEAT EMITTING SURFACE
Z. K. Karasev *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 251–260 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

An investigation was undertaken on the effect of rectangular turbulizers with various fin width to fin height ratios, and interfin distance (in meters) to fin height ratios on the fluid resistance, the structure of the flow, and on the local heat transfer. Data obtained from wind tunnel tests include the fluid flow resistance coefficient and the Nusselt number value. Graphs are plotted to show the relative pressure drop at a smooth wall in the channel with turbulizers, and the dependance of the degree of turbulization at various parameters. Experiments show that the flow between the fins can, by convection, be broken up to three main zones. Earlier investigations of the kinematics of the flow are substantiated. It is also shown that the turbulent zone of the flow undergoes appreciable changes in comparison with flow in a smooth channel, and that the turbulent energy dissipation in the convergence zone takes place primarily in the turbulent wake adjoining the main body of the flow, and not in the region adjoining the wall. R.Li.

N67-11226 RAND Corp., Santa Monica, Calif.
CONVECTIVE HEAT TRANSFER IN CYLINDRICAL CHAMBERS WITH RECIRCULATION
A. S. Nevskii, A. V. Arseev, L. A. Chukanova, A. I. Malysheva, and T. V. Sharova *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 261–270 (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

Since the phenomenon of recirculation of gases creates unique conditions in heat transfer between the gas and the walls of a chamber, a series of experiments were undertaken to determine convective heat transfer in cylindrical chambers. Details are given for the air-fed experimental chambers and the main nozzle dimensions. The ratio of the air velocities fed through the central and the outer nozzles, and the dimensions of the nozzles were varied. Tests were also made with air fed only with the central nozzle, and only with the annular nozzle, as well as experiments with feed of preheated air through one nozzle and cold air through the other. One experiment was made with feed of swirling air, and two experiments with an air feed proportional to the cross section of the chamber. All of the twenty-nine experiments are described in detail. R.Li.

N67-11227 RAND Corp., Santa Monica, Calif.
SOME CASES OF HEAT TRANSFER AND FRICTION IN LONGITUDINAL FLOW PAST HEAT TRANSFER ELEMENTS
K. Rybachek *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 271–282 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

In connection with the design of effective heat transfer elements for nuclear reactors, the problem of heat transfer in turbulent flow past longitudinally and circumferentially finned tubes was studied. It was established that heat transfer for bundles of longitudinally-finned tubes was slightly lower than for flow in channels, while the values obtained for the resistance of such systems were higher than the accepted values for smooth channels by 10 to 30%. R.Li.

N67-11228 RAND Corp., Santa Monica, Calif.
INVESTIGATION OF HEAT DISSIPATION AND RESISTANCE OF FINNED CHECKERWORK STACKS WITH VARIOUS FIN SHAPES
V. F. Yudin and L. S. Tokhtarova *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 283–284 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

In order to find the most efficient kind of fin system, comparative investigations were made of the heat dissipation and flow resistance of finned, checker-work (crossed tubes) stacks made from tubes, using pin-shaped round and flat fins, disk-shaped fins, wire fin systems, and disk-shaped, sawtooth-edge fins. The heat transfer coefficient was evaluated on the basis of the thermal load which was determined on the basis of the amount of electric power used for heating the calorimeter. Tabular data indicate the shapes and geometric dimensions of the finned tubes tested, as well as the amounts of heat transfer and values of flow resistance. It was found that despite the substantial differences in the fin shape and, consequently, in the character of flow past them, the heat transfer from their surface is practically the same. It is therefore concluded that the shape of the fins has no appreciable effect on the heat transfer process. R.Li.

N67-11229 RAND Corp., Santa Monica, Calif.
GENERALIZATION OF HEAT TRANSFER AND PRESSURE DROP RELATIONSHIPS FOR GAS FLOW ACROSS A BUNDLE OF FINNED TUBES
I. Vampola *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 295–305 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

For application to optimal dimensions of fins, a series of experiments was carried out to derive precise heat transfer and pressure drop relationships. A generalization, derived from experimental data, is elaborated for gas flow across finned tubes. It is stated that when a gas flows over a bundle of finned tubes the total heat transfer is equal to the sum of heat transferred by radiation and by convection. If the fin spacing is small, the complex radiation conditions may be replaced by radiation from the envelope of the heat exchanger to the surrounding walls. Since the ratio of the area of the envelope to the total surface of the heat exchanger is small, the radiation component of the heat transferred can be neglected. A mathematical expression is presented for the heat transferred in the case of thin-walled tubes. For the determination of thermal and hydraulic characteristics, approximately 30 different configurations of finned tubes were investigated. The heat transfer coefficients inside the tubes for turbulence were calculated, and thus the heat transfer coefficient at the fins derived. R.Li.

N67-11230 RAND Corp., Santa Monica, Calif.
EFFICIENCY OF HEAT TRANSFER SURFACES
A. I. Mitskevich *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 306-314 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

A method is proposed for evaluating the efficiency of convective heat transfer for different surfaces. In the technique, the ratio of heat transfer is obtained for identical design volumes occupied by a standard heated surface (with which other surfaces are compared), and the test heated surface. The ratio, or efficiency coefficient, is determined at equal pumping power required for the heat transfer medium, and with equal temperature drops between the standard and test heated surfaces and the heat transfer medium. The efficiency coefficient can be determined analytically, if the heat transfer parameters and the hydraulic resistance of the surfaces being compared are known. It is pointed out that as the comparison of heat transfer surfaces is carried out with identical design volumes and not by the amount of surface areas, inaccuracies in interpreting the results can be eliminated. M.G.J.

N67-11231 RAND Corp., Santa Monica, Calif.
THE UNSTEADY LAMINAR THERMAL BOUNDARY LAYER FOR FLOW OF A VISCOUS FLUID OVER A SEMI-INFINITE PLATE
Yu. L. Rozenshtok *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 317-330 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The application of the Karman-Pohlhausen integral method is proposed as a solution to boundary layer formation problems. Neglecting viscous dissipation and the change in physical properties of the fluid with temperature, equations are formulated for the unsteady state boundary layer for flow over a flat plate. By integrating the equations over the thickness of the dynamic boundary layer and the thermal boundary layer, it is shown that the Prandtl equation leads to the Karman integral relationships for such dimensionless variables as velocity, temperature of the free stream, and the wall temperature. Boundary and initial conditions are formulated for the case of an isothermal plate brought suddenly into uniform motion from a state of rest. A fourth-degree polynomial is used to approximate the velocity and temperature profiles in the boundary layers. Three examples are given in which the Prandtl number is equal to unity, is greater than unity, and is less than unity. M.G.J.

N67-11232 RAND Corp., Santa Monica, Calif.
DETERMINATION OF THE FLOW TEMPERATURE AND FRICTION COEFFICIENTS IN CHANNELS WITH UNSTEADY-STATE FLOW OF THE HEAT TRANSFER MEDIUM
E. K. Kalinin *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 331-342 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

The energy equation, expressed per unit of volume for one-dimensional unsteady state flow in a channel with heat input is formulated. Heat supply from dissipation and from gas compression is not considered due to its smallness in comparison with the heat flux per unit volume of the flowing heat transfer medium in all heat exchange equipment. In the case of flow of gaseous heat transfer media at Mach numbers greater than 0.6 to 0.7, the thermodynamic temperature in the equation is replaced by the stagnation temperature. Solutions to the Cauchy problem for various regions are given. M.G.J.

N67-11233 RAND Corp., Santa Monica, Calif.
ESTIMATION OF INFLUENCE OF THERMAL UNSTEADY STATE ON CONVECTIVE HEAT TRANSFER COEFFICIENT FOR SPHERICAL BODIES IN FLOW AT SMALL REYNOLDS NUMBERS
L. I. Kudryashev and A. A. Smirnov *In its* Proc. of the 2d All-Soviet Union Conf. on Heat and Mass Transfer, Vol. I Aug. 1966 p 343-353 refs (See N67-11201 02-33) Available from Calif. Univ. Press, Los Angeles: $7.00

A general method is presented for solving the problem, and differential equations are derived to determine the convective heat transfer coefficient in which the influence of the thermal unsteady state is considered. In the suggested method, the integral relationships of the Karman type are applied, and the approximate solutions obtained are found to have the required degree of accuracy. M.G.J.

N67-11301# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF ENGINEERING PHYSICS
1 Apr. 1966 23 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 7, no. 7, Jul. 1964 p 47-52, 75-79
(FTD-MT-65-184; TT-66-62091; AD-637415) CFSTI: HC $1.00/MF $0.50

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1. **MEASUREMENT OF THE SPEED OF GAS IN AN INFLAMMABLE MEDIUM** G. D. Salamandra and I. K. Fedoseyeva p 1-9 refs (See N67-11302 02-33)

2. **APPLICATION OF THE ZONAL METHOD OF CALCULATION TO ASYMMETRIC PROBLEMS OF THERMAL CONDUCTION** Yu. V. Vidin and G. P. Boykov p 11-17 refs (See N67-11303 02-33)

N67-11302# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF THE SPEED OF GAS IN AN INFLAMMABLE MEDIUM
G. D. Salamandra and I. K. Fedoseyeva *In its* J. of Eng. Phys. 1 Apr. 1966 p 1-9 refs (See N67-11301 02-33) CFSTI: HC $1.00/MF $0.50

Measurement of the speed of gas in an inflammable medium a method of measuring the flow velocity of a gas in an inflammable medium is described. The speed of the gas is measured in terms of the shift of a thermal heterogeneity created in the motionless medium by the heating of a small volume of gas by a thin Nichrome wire, connected to the discharge circuit of a condenser. Examples are given of the use of the method for measuring the speed of gas ahead of a flame front and behind incident and reflected shock waves. TAB

N67-11303# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF THE ZONAL METHOD OF CALCULATION TO ASYMMETRIC PROBLEMS OF THERMAL CONDUCTION
Yu. V. Vidin and G. P. Boykov *In its* J. of Eng. Phys. 1 Apr. 1966 p 11-17 refs (See N67-11301 02-33) CFSTI: HC $1.00/MF $0.50

A solution is proposed for the calculation by the zonal method of the asymmetric heating of an infinite (unbounded) plate under the action radiation. TAB

N67-11312# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
COOLING RATES IN SPLAT COOLING Technical Report No. 12
Robert C. Ruhl 1 Sep. 1966 32 p refs
(Contract Nonr-1841(38))
(DSR-7618; AD-639092) CFSTI: HC $2.00/MF $0.50

Calculations and experimental observations made on cooling rates during splat quenching are presented. Three possible types of cooling behavior are discussed: ideal cooling, intermediate

cooling, and Newtonian cooling. The effects of splatting-process variables on the cooling rates are described, the most important of these variables being splat thickness and the quality of the thermal contact between the splat and substrate. Splat-cooling rates range typically from 10,000 to above 10 to the 10th power C/sec., depending on the actual conditions Author (TAB)

N67-11699*# Mississippi State Univ., State College. Dept. of Mechanical Engineering.
VIBRATION EFFECTS ON HEAT TRANSFER IN CRYOGENIC SYSTEMS Quarterly Progress Report No. 1, Jun. 1–Aug. 31, 1966
E. H. Bishop, C. J. Bell, C. T. Carley, R. E. Forbes, E. W. Wellborn et al 31 Aug. 1966 54 p refs
(Contract NAS8-20284)
(NASA-CR-79540; QPR-1) CFSTI: HC $3.00/MF $0.50 CSCL 20M

Results are presented for an intensive search of published research on natural convection within enclosures, the effects of vibration on natural convection, and the effects of vibration on fluid transport properties (thermal conductivity and viscosity). The governing equations for the initial geometrical configuration for the natural convection study are formulated in dimensionless form and discussed, and the final initial design of the companion experimental system is presented. A brief general discussion of the transport-property study is given. Author

N67-11713# Atomics International, Canoga Park, Calif.
EFFECTS OF SOME SURFACE AND SYSTEM CONTAMINANTS ON MERCURY POOL BOILING HEAT TRANSFER
T. T. Shimazaki 15 Jul. 1966 62 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11949) CFSTI: HC $3.00/MF $0.75

The effects of some surface and system contaminants on mercury pool boiling heat transfer were investigated to: (1) explore the validity of the loss-of-adequate-wetting hypothesis proposed as an explanation for Mercury Rankine Program boiler deconditioning, and (2) determine to which contaminants the loss of wetting is attributable. The results indicate that loss of adequate wetting is the most likely cause of boiler deconditioning, and that the effect of oil contamination on loss of wetting is much more severe and permanent than air or water contamination. Author (NSA)

N67-11735*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.
FLAME SPREADING OVER THE SURFACE OF DOUBLE BASE PROPELLANTS AT HIGH PRESSURE Annual Report
Robert F. Mc Alevy, III, John A. Wrubel, and Richard S. Magee (M.S. Thesis) Oct. 1966 62 p refs
(Grants NsG(T)-77/31; NGR-31-003-014)
(NASA-CR-79542; ME-RT-66010) CFSTI: HC $3.00/MF $0.75 CSCL 21B

In an elementary flame spreading experiment conducted in a high pressure quiescent environment, the rate of flame spreading over the igniting surface of two solid rocket propellants was measured under various conditions of pressure and chemical reactivity of the surrounding atmosphere. The flame spreading velocity, which was obtained cinematographically, was found to vary: directly with pressure level (between 6 and 415 psia); and directly with the oxygen weight fraction in environments composed of oxygen–nitrogen mixtures. An equation was derived to demonstrate that all data, except those taken in 100% nitrogen, could be correlated. Flame spreading data taken in 100% nitrogen yielded velocities approaching those of the linear burning rate; in 100% oxygen at 415 psia, the velocity was greater than the linear burning rate by approximately a factor of 15. It is concluded that in inert environments what appears to be flame spreading is merely normal deflagration of a plane oriented at an angle slightly greater than 90° with the surface of interest. M.G.J.

N67-11812*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PRELIMINARY INVESTIGATION OF OXIDIZER-RICH OXYGEN-HYDROGEN COMBUSTION CHARACTERISTICS
Curtis R. Bailey Washington, NASA, Dec. 1966 30 p ref
(NASA-TN-D-3729) CFSTI: HC $2.00/MF $0.50 CSCL 21B

The operating characteristics of oxygen-hydrogen combustion were investigated over a propellant mixture ratio (O/F) band of 20 to 150. Firings were conducted in a 3600 pound thrust combustor at a chamber pressure of 1000 psia. Wedges fabricated from Inconel-X, Rene-41, and Waspalloy were placed in the exhaust of the combustor and subjected to the hot gases ranging in mixture ratio from 75 to 150. There were no significant heating problems with any of the combustor components. There was no erosion or melting of the test wedges except during a mixture ratio shift through stoichiometric in the start transient of one firing. Maximum characteristic velocity efficiencies of approximately 85 percent were achieved at propellant mixture ratios of 23 and 144. A minimum value of approximately 70% was observed at a mixture ratio of 70. Author

N67-11888# Applicazioni e Ricerche Scientifiche, Milan (Italy).
RESEARCH ON THERMODYNAMICS AND DYNAMICS OF GAS MIXTURES WITH TWO RATE PROCESSES Interim Report
R. Monti [1966] 116 p refs
(Contract Nonr-4544(00))
(AD-638731) CFSTI: HC $4.00/MF $0.75

Part I recalls the findings of previous work, in general doubly reacting gas mixtures, and outlines the procedure to be followed in Part II and III. Part II develops a model for a two biatomic gases mixture, the first gas may vibrate in non-equilibrium and the second gas may dissociate in non-equilibrium. State equations, stability matrix, characteristic speeds, specific heats are given as functions of the thermodynamic variables chosen for the analysis. Part III develops a model of a single biatomic gas which may vibrate and dissociate in non-equilibrium, again all the expressions of the thermodynamics functions are given. In Part IV, a thermokinetic model for the mixtures considered in Part III is developed; the rate processes and the kinetic matrix are derived, and the range of validity of the linearized equations and the effect of coupling are investigated in detail. The last part considers applications of the model developed in Parts III and IV to the nozzle flow problem and a sample calculation developed by numerical methods is reported Author (TAB)

N67-11893# Naval Radiological Defense Lab., San Francisco, Calif.
ON THE FEASIBILITY OF ANALYZING ABLATOR BLOW-OFF GASES WITH A TIME-OF-FLIGHT MASS SPECTROMETER
Kenneth A. Lincoln 4 Apr. 1966 52 p refs
(USNRDL-TR-1014; AD-634135) CFSTI: HC $3.00/MF $0.50

The subject of determining the composition of blow-off gases from rapidly heated ablators is treated entirely from the experimental point of view. The various equipment requirements are briefly described including the thermal sources for heating materials as well as the vacuum systems needed to sample the gases directly from the pyrolysis zone into the inlet of the spectrometer. Particular attention is given to the state of the art of time-of-flight (TOF) mass spectrometry. The unique abilities of the instrument as well as its limitations are assessed, and the instrumental factors which influence mass spectral patterns are carefully delineated. The equipment presently available for recording output spectra is appraised and the corresponding limitations are outlined. In addition, the subject of quantitative analysis of

gaseous mixtures by mass spectrometry is reviewed with particular reference to the TOF instrument and its application to ablation-product analysis. This is extended to include an exploration into the possibilities of utilizing electronic data-computing machines to resolve complex mixture mass spectra into meaningful chemical analysis. Author (TAB)

N67-11909# Aeronautical Research Labs., Melbourne (Australia).
CALCULATIONS FOR ANEMOMETRY WITH FINE HOT WIRES
W. W. Wood Nov. 1965 18 p refs
(ARL/A-252) CFSTI: HC $1.00/MF $0.50

The heat transfer appropriate to low Reynolds number hot wire anemometry is calculated by an Oseen approximation. The second and third iterates yield close agreement with measured data. Author

N67-11996# Aeronautical Research Inst. of Sweden, Stockholm.
OPTIMISATION OF THE REDUCTION OF TRANSIENT HEAT TRANSFER DATA
H. Thomann and G. Lindejoe Mar. 1966 14 p ref
(FAA-108) CFSTI: HC $1.00/MF $0.50

In many cases an unknown function T(t) is approximated by a number of observations $T_i(t_i)$ and the slope $\partial T/\partial t$ is needed. This is often done by fitting a polynomial through a group of the points $T_i(t_i)$ using the least square method. In the present paper, the error introduced into the slope is determined for some cases which are representative for experiments, using the transient heat transfer technique. The results can either be used when new experiments are planned or when the best combination of parameters (number of points approximated by the polynomial, degree of polynomial) has to be determined for the reduction of existing data. It is found that, within the framework of assumptions made, a second degree polynomial gives exactly the same slope as one with a first degree. The same is true for the third and fourth degree, fifth and sixth degree etc. Therefore, polynomials with an even degree should not be used in this connection as they do not improve the accuracy of the result. Author

N67-12004# Joint Publications Research Service, Washington, D. C.
RELATIONS BETWEEN THERMODYNAMICS, INFORMATION AND THOUGHT DESCRIBED
A. Mitskevich 8 Nov. 1966 12 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), no. 9, 1966 p 7-9
(JPRS-38540; TT-66-34965) CFSTI: $1.00

A discussion of the human thought process, physiochemical processes on the atomic/molecular level which store and transmit information, and the importance of consciousness and the spiritual qualities of man in man-machine systems is presented. Emphasized is the significance of these factors in the design and development of thinking machines from nonbiological elements such as transistors, glass enclosed vacuum tubes, or pneumatic elements of computers. S.C.W.

N67-12108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE EFFECT OF UNCERTAINTIES IN TRANSPORT PROPERTIES ON PREDICTION OF STAGNATION POINT HEAT TRANSFER
D. W. Zeh and T. E. Horton *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 27-28 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

As previous analytical data showed that significant differences existed in the transport properties generated by various workers, experiments were conducted to confirm that similar trends existed in the predicted flow and convective heating of the stagnation region of an axisymmetric blunt body. The flow was assumed to be laminar in chemical equilibrium, and is described by the compressible form of the boundary layer equations, with real gas effects accounted for by use of the total property concept. Viscous dissipation and compression work were ignored. The equations are formulated, and the solution achieved by an iterative numerical technique for a wall temperature of 1000°K and a stagnation pressure of 1 atm for three different sets of transport properties for air. The effect of transport properties on the stagnation point convective heat transfer in air is plotted; maximum difference in predicted heat transfer is seen to be about 20%. M.G.J.

N67-12117*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LITHIUM-BOILING POTASSIUM RANKINE CYCLE HEAT-TRANSFER DATA
G. M. Kikin *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 50-63 ref (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The primary objectives are listed for the two-loop lithium boiling potassium facility for simulating the major elements and working fluids of two-loop nuclear concepts applicable to spacecraft propulsion. Preceding loop operations are reviewed, current test sequences are summarized, fabrication techniques are mentioned, and pertinent loop component and behavioral experiences are discussed. M.G.J.

N67-12158*# California Univ., Berkeley. Office of Research Services.
DEVELOPMENT OF DETONATION IN LIQUID FUEL SPRAY WITH GASEOUS OXIDIZER PRELIMINARY EXPERIMENTS
D. H. Morris, S. Wojcicki, and A. K. Oppenheim Oct. 1966 48 p refs
(Grant NsG-702)
(NASA-CR-80098; AS-66-15; TN-3) CFSTI: HC $2.00/MF $0.50
CSCL 21B

Experimental apparatus for the study of accelerating flames in a two-phase mixture consisting of a liquid fuel spray in a gaseous oxidizer is described. Observations of the development of detonation in liquid kerosene–oxygen mixtures made by means of streak self-light photographs in a 1-1/2 inch square plexiglas tube, initially at atmospheric pressure and room temperature, are reported. Due to the slow reaction kinetics of a two-phase system, as compared to a homogeneous gaseous mixture, acceleration of the combustion front was found to be controlled primarily by the flow field ahead of the flame, and this was attributed to the effect it had on the power density of energy deposition in the reaction zone. Results of experimental observations represented on the induction time–distance plane demonstrate a distinct dependence of the plot on the manner in which combustion was initiated, the time to distance ratios being larger when it occurred at a point than in the cases when it started in the form of a bulk explosion. Results of numerical thermodynamic-equilibrium analysis of pressure, density, temperature, velocity and Mach number for Chapman–Jouget detonations are given as a function of stoichiometric ratio. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N67-11241*# International Business Machines Corp., Yorktown Heights, N. Y.
IMPLEMENTATION, TEST AND EVALUATION OF A SELECTIVE DISSEMINATION SYSTEM FOR NASA SCIENTIFIC AND TECHNICAL INFORMATION Final Report
Jun. 1966 95 p
(Contract NASw-695)
(NASA-CR-62020) CFSTI: HC $2.50/MF $0.75 CSCL 05B

The development of a large scale selective dissemination of information program, its experimental operation, and program evaluation is reported. An IBM 7090/94 computer program compared user interest profiles with the subject indexes of reports announced in Scientific and Technical Aerospace Reports. Users were provided with selected announcements in the form of abstract cards. Profile preparation is described, and announcement and response media are illustrated. During the exploratory operation of the program, 500 NASA and 200 Air Force personnel served as participants and evaluators of the system. A statistical evaluation of system performance is included, and results of a questionnaire concerning user opinions and comments are presented. Author

N67-11243*# National Aeronautics and Space Administration, Washington, D. C.
NASA SELECTIVE DISSEMINATION OF INFORMATION PROGRAM (IBM 7090/94 SYSTEM)
Gifford A. Young Jun. 1966 80 p
(NASA-TM-X-57001) CFSTI: HC $2.50/MF $0.70 CSCL 05B

NASA's SDI Program is a response to the accelerating growth of information and the corresponding need of scientific and engineering staffs for selected portions of this information. Computers are programmed to compare the subject indexes of documents against the expressed interests of SDI participants to select appropriate documents for announcement or direct distribution. Exceptional flexibility is possible in expressing user interests; match options include "must" single work descriptors, two to seven word phrases, "not" terms and phrases, and percentage matching, plus a number of special descriptors such as contract numbers. In preparing the input document and user interest profiles for matching, a dictionary program provides machine generated codes and can substitute cross-referenced descriptors. The hardware required includes an IBM 7090/94 with 32K storage, two IBM 7607 data channels, and eight IBM 729 tape drives. System output consists of tab card sized abstract cards. A response card provides for expression of interest by manual punchout and may be used to request the full text of selected documents. System operating experience is presented, program modifications are described, and program availability is discussed. R.N.A.

N67-11271# Howard Research Corp., Arlington, Va.
IDENTIFICATION OF DISCIPLINES AND FIELDS
3 Jan. 1966 125 p refs
(Contract DA-44-009-AMC-806(T))
(AD-634323) CFSTI: HC $4.00/MF $0.75

The report presents the identification and definitions of subject-oriented engineering and scientific disciplines and fields which are included in the EDIS Subject Categories. The discussion is extended to include the mix of subjects with other orientations, such as Item, Mission-Project, Expertise and Data Bank Categories. Sample queries are utilized to search the Subject and Item Categories. An EDIS categorization scheme, which is applicable to all categories, is derived. Potential application of the scheme to common data and information is discussed. The report also discusses the conversion of categories from a classification scheme to the EDIS subject Categories. The final section discusses the advantages and limitations of forming field combinations. Author (TAB)

N67-11339*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
RESEARCH PROGRAM ON THE MANAGEMENT OF SCIENCE AND TECHNOLOGY Annual Report, 1964–1965
Donald G. Marquis Jul. 1965 58 p refs
(Grant NsG-235)
(NASA-CR-79701) CFSTI: HC $3.00/MF $0.50 CSCL 05A

A summary is presented of the progress and plans of a program of research and education on the problems of organizing and managing large scale technology based enterprises. Studies are focused on the objectives of understanding and improving the effectiveness of research and development activities and the use of science and technology for general welfare. Discussions are included on problem solving; organization and management of large projects; individual impersonal factors in research and development; research institutions; government contracting for research and development; sources and uses of new technology; economic and social effects of new technology; and educational activities. H.S.W.

N67-11399*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ASPECTS OF THE THEORY OF SYNTAX Special Technical Report No. 11
Noam Chomsky Cambridge, M.I.T. Press, 1965 259 p refs
(Grants NsG-496; NSF GP-2495; NIH G-MH-04737-04; Contracts DA-36-039-AMC-03200 (E); AF 19(628)-2487)
(NASA-CR-79495) CFSTI: HC $6.00/MF $1.25 CSCL 05G

Developments in the formulation of transformational grammar are reviewed, and a reformulation of the theory is proposed. The emphasis is placed on syntax; semantic and phonological aspects of language structure are discussed only insofar as they bear on syntactic theory. Background assumptions are summarized, and essential points are clarified. Defects in earlier versions of the theory are pointed out, and the work of Chomsky and Lees is discussed. L.E.W.

N67-11707# Oak Ridge National Lab., Tenn.
TABLES OF 10-10 URANIUM UNIT COST COMPONENTS
27 Jan. 1965 94 p
(Contract W-7405-ENG-26)
(K-OA-1313) CFSTI: HC $3.00/MF $0.75

The tables are to be used in calculations involving gaseous diffusion plant operations. The tables list the natural feed cost component and the separative work cost component of uranium at tails assays from 0.10 to 0.65% ^{235}U for a natural feed unit cost of $10.00/kg U as UF_6 and a separative work unit cost of $10.00/kg U. The tables can be used to calculate the unit cost of uranium at other unit costs of natural feed and separative work. NSA

N67-11841*# Washington Univ., St. Louis, Mo. Dept. of Economics.
FEDERAL NON-DEFENSE EXPENDITURES: THEIR SHIFTING IMPACT ON THE REGIONAL DISTRIBUTION OF INCOME
Gerald W. Williams Nov. 1966 32 p refs Its Working Paper 6609
(Grant NsG-342)
(NASA-CR-79997) CFSTI: HC $2.00/MF $0.50 CSCL 05C

The purposes of this study are: (1) to identify the redistributional impact on regional income of certain Federal public welfare and economic development expenditure programs; and (2) to analyze this impact for selected years in the period 1948–1965. Tabulated data of the various programs are presented, and two hypotheses are analyzed, namely (1) that development programs at any point in time are progressive and hence equalize regional income; and (2) that development programs, welfare programs, and the combination of the two, equalize regional income over

time. Although no conscious effort by the Federal government to redistribute regional income is apparent, it is pointed out that the effects of expenditure programs must be taken into account when Federal spending is decided. K.W.

N67-11943*# Adelphi Univ., Garden City, N. Y.
THE NASA WESTERN UNIVERSITY CONFERENCE Summary Report
Donald E. Cunninghan Washington, NASA, 1966 55 p refs Conf. held at JPL, 8–9 Nov. 1965
(NASA-SP-122) CFSTI: HC $2.50/MF $0.50 CSCL 05A

During this regional western conference, speakers from NASA research centers discussed scientific work being undertaken and the means available for NASA–university cooperational studies. In addition to presenting a comprehensive picture of the NASA program and a description of the mechanisms through which faculty members can participate in these activities, particular attention was directed to NASA's west coast installations: the Jet Propulsion Laboratory, the Ames Research Center, and the Flight Research Center at Edwards Air Force Base. G.G.

N67-11965*# Massachusetts Inst. of Tech., Cambridge. Alfred P. Sloan School of Management.
SOME CHARACTERISTICS OF TECHNICAL ENTREPRENEURS
Edward B. Roberts and Herbert A. Wainer May 1966 32 p refs
(Grants NsG-235; NsG-496)
(NASA-CR-77278; Rept.-195-66) CFSTI: HC $2.00/MF $0.50 CSCL 05J

Sixty-nine technical entrepreneurs were studied emphasizing description of several of their characteristics such as family background, education, and motivation. The results indicate that entrepreneurial fathers are more likely to produce entrepreneurial sons. An individual's home environment and attitudes that seem to be embodied in his religious background are likely to have strong influences on his goal orientation, education, and whether or not he becomes an entrepreneur. In addition, those technical entrepreneurs whose fathers had high occupational status were educated sooner and to a higher level than those whose fathers had low occupational status. At the same time it was determined that the technical entrepreneurs who had self-employed fathers were educated usually to around the Master of Science degree level, the median education of the entire sample. Author

N67-12014 Joint Publications Research Service, Washington, D. C.
APPLICATION OF ORGANIZATION CONTROL SYSTEMS
V. Yu. Nevryaev et al 23 Nov. 1966 13 p Transl. into ENGLISH of a Report Originally Entitled "Metodicheskiye Materialy Po Sozdaniyu i Primeneniyu Sistem Organizatsionnogo Upravleniya, Vyp 1 Printsipy Postroyeniya Setevykh Modeley Kompleksov Operatsii" Moscow, Inst. of Automation and Telemechanics, 1964
(JPRS-38762; TT-66-35186) CFSTI: $1.00

Presented is a discussion of basic concepts and methods used in the development and application of organization control systems for handling complex operations. S.C.W.

N67-12017# Pennsylvania Univ., Philadelphia. Management Science Center.
MODEL STUDY OF ESCALATION. VOLUME I: SUMMARY Report of 1964–1965 Studies
Russell L. Ackoff, Wroe Alderson, Jacqueline Anderson, James R. Emshoff, William Gomberg et al 1 Mar. 1966 52 p refs
(Contract ACDA/ST-64)

A model study is being conducted to identify properties of conflicts and cooperation which produce escalation, de-escalation, and control. This report defines the study tasks; discusses the research plan and its logic; outlines the organization of the research effort; describes work done in the areas of reality analysis, experiments with artificial reality, and the use of a simple conflict situation; and includes plans for further research. The appendix discusses the nature and measures of conflict and related concepts. R.N.A.

N67-12018# Pennsylvania Univ., Philadelphia. Management Science Center.
MODEL STUDY OF ESCALATION. VOLUME 2: SECTIONS 2–5
Russell L. Ackoff, Wroe Alderson, Jacqueline Anderson, James R. Emshoff, William Gomberg et al 1 Mar. 1966 101 p refs
(Contract ACDA/ST-64)

A study is being conducted to develop a quantitative model of conflict behavior, to design an artificial reality to test the predictive power of the quantitative models and to study hypotheses about the escalation or de-escalation of conflict situations, and to formulate hypotheses to be tested. Conflict literature was surveyed and hypotheses derived to identify basic variables in conflict situations. Based on the variables identified and the hypotheses reviewed, an artifical reality game was developed and is described. The results of statistical and qualitative analyses of the game are given. A computer simulation model was created to investigate the consequences of behavioral hypotheses in basic game situations. The model was formulated using the decision theory concept of utility maximization and contains four parameters: memory, foresight, competitiveness, and rigidity. Details of the model are presented along with the scheme used to fit the parameters to actual data, the results of the model's fit to game data, and comments, criticisms, and suggestions for possible future studies. A program for continuing research in conflict escalation and de-escalation is outlined. R.N.A.

N67-12019# Pennsylvania Univ., Philadelphia. Management Science Center.
MODEL STUDY OF ESCALATION. VOLUME 3: APPENDICES 2–12 Report of 1964–1965 Studies
Russell L. Ackoff, Wroe Alderson, Jacqueline Anderson, James R. Emshoff, William Gomberg et al 1 Mar. 1966 145 p refs
(Contract ACDA/ST-64)

Appendices are presented to a study which is being conducted to develop a quantitative model of conflict behavior, to design an artificial reality to test the predictive power of the quantitative models and to study hypotheses about the escalation or de-escalation of conflict situations, and to formulate hypotheses to be tested. Included are an annotated bibliography, an interpretation of the Prisoner's Dilemma matrix, early versions of artificial reality, hypotheses extracted from the literature, a description of artificial reality, player's rules for Prisoner's Dilemma experiments, a summary of interviews during microgames, a Fortran program of simulated player's decision routine, simulation results, game data on player reaction to a cooperation attempt after a defection lock-in, and preliminary consideration of extending artificial reality to a multi-player situation. R.N.A.

N67-12021# Congress. House. Committee on Appropriations.
INDEPENDENT OFFICES APPROPRIATIONS FOR FISCAL YEAR 1967
Washington, GPO, 1966 1872 p Hearings before a Subcomm., 89th Congr., 2d Sess., Pt. 2

Hearings on fiscal year 1967 budget requests presented before the House of Representatives subcommittee of the committee on Appropriations are reported. Detailed are proposed requests by: the Department of Housing and Urban Development, Federal Home Loan Bank Board, Federal Savings and Loan Insurance Corporation, National Aeronautics and Space Administration, National

Aeronautics and Space Council, National Science Foundation, Office of Science and Technology, and Veteran's Administration. Testimonies of members of Congress and other interested individuals and organizations are included. S.C.W.

N67-12022# Congress. House. Committee on Science and Astronautics.
NASA AUTHORIZATION FOR FISCAL YEAR 1967
Washington, GPO, 1966 881 p Hearings before the Subcomm. on Space Sci. and Appl. 89th Congr., 2d Sess. on H.R. 12718, Pt. 3 Superseded by H.R. 14324

Congressional subcommittee hearings on NASA's fiscal year 1967 budget request in the area of space science and applications are reported. Detailed are primary objectives of NASA in the areas of science, technology, and engineering; proposed lunar and planetary flight programs; and technical developments which have nonaerospace industrial applications. S.C.W.

N67-12025# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ASTRO-ARCHAEOLOGY
Gerald S. Hawkins 28 Oct. 1966 70 p refs
(SAO Special Rept.-226)

Criteria for chronologically dating and reconstructing prehistoric structures on the basis of astronomical alignments are reported. To demonstrate the applicability of the proposed criteria in astro-archeological studies, astronomical alignments of Stonehenge I, II, and III are calculated. S.C.W.

N67-12026# National Bureau of Standards, Washington, D. C.
NATIONAL STANDARD REFERENCE DATA SYSTEM Status Report
Edward L. Brady, ed. 1 Jun. 1966 86 p refs
(NBS-TN-289) GPO: $0.50

This report summarizes the status of the activities of the NBS Office of Standard Reference Data as of March, 1966. It provides a detailed review of the data compilation activities within the seven broad categories within the technical scope of the program: nuclear data, atomic data and molecular data, solid state data, thermodynamic and transport data, chemical kinetics, colloid and surface properties, and mechanical properties. Plans for an information service program are also outlined. Certain problem areas are also identified. Author

N67-12082*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FY 1966 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
Oct. 1966 43 p refs
(NASA-TM-X-59077; MS-I-66-02) CFSTI: HC $2.00/MF $0.50 CSCL 05B

A bibliography is given of the formal NASA technical reports, the papers published in technical journals, and the presentations made by Marshall Space Flight Center personnel and their contractors FY66. Author, title, and date and place of presentation or publication are included. L.E.W.

N67-12101*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-40, VOLUME IV FOR THE PERIOD JUNE 1, 1966 TO JULY 31, 1966. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Aug. 1966 236 p refs
(Contract NAS7-100)
(NASA-CR-79917; JPL-SPS-37-40, Vol. IV) CFSTI: HC $3.75/MF $1.25 CSCL 22B

Articles on current supporting research and advanced development efforts conducted or managed by the Jet Propulsion Lab. are presented by the Guidance and Control, Engineering Mechanics, Environmental Simulation, Propulsion, Space Sciences, and Telecommunications Divisions. For individual titles see N67-12102–N67-12149.

N67-12108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE FEASIBILITY OF ACHIEVING OPTICAL DENSITIES IN MAGNETIC INFORMATION STORAGE
D. I. Tchernev *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 22–23 refs (See N67-12101 02-34) CFSTI: HC $3.75/MF $1.25

The feasibility of having a magnetic memory with a storage density of on the order of 10^9 bits/cm^2 is investigated. The Faraday effect in many magnetic materials and the discontinuous film method are assessed, and their disadvantages pointed out. Thermal writing, or the Curie point writing method, for high density magnetic writing is considered to be the most promising technique. This involves heating a small area of the magnetic material to the vicinity of the Curie point, thus reducing its coercive force so that a weakly applied magnetic field can change the direction of magnetization within this area without affecting the areas which are not heated. The main difficulty in obtaining magnetic information at optical densities is identified as the interaction between separate bits of information at short distances. However, the possibility of storing magnetic information at densities of 10^9 bits/cm^2 is believed to be feasible. M.G.J.

N67-12157*# Missouri Univ., Columbia. Business and Public Administration Research Center.
RESEARCH AND REGIONS. A KWIC INDEXED BIBLIOGRAPHY
John C. Murdock and Judith Graves, comp. [1966] 228 p refs
(Grant NGR-26-004-012)
(NASA-CR-8009)

A bibliography of works that include relevant references to location and regional development and to the economics and administration of research is presented. The publication illustrates a novel application of data processing techniques to the broader problems of information retrieval in economics. Its aim is to provide material for certain specialized areas in economics and administration and to apply recently developed computerized techniques to the field of economics and administration. S.P.

N67-12221*# Stanford Univ., Calif. School of Engineering.
PRINCIPLES, TECHNIQUES AND APPROACH USED IN CONDUCTING PROGRAM IN SPACE SYSTEM ENGINEERING
William Bollay et al 1966 57 p refs
(Contract NSR-05-020-151)
(NASA-CR-79753) CFSTI: HC $3.00/MF $0.75 CSCL 05I

This report covers a summary of the principles, techniques, and approaches used in teaching a course in space system engineering. The professor-trainees carried out a system engineering study of ICARUS, an advanced solar probe to explore the region of the solar system between 0.1 AU and 1 AU. During the 10-week summer study the participants encountered similar problems and difficulties as well as successful achievements as are normally met by the graduate students over a 15- to 20-week course during the school year. Thus they obtained a good appreciation of what is involved in offering similar programs at their home schools. Author

N67-12259*# California Univ., Berkeley. Space Sciences Lab.
A NOTE ON EQUILIBRIUM SYSTEMS FROM A DIALECTICAL (TENSIONAL) POINT OF VIEW

T. A. Cowan Oct. 1966 28 p refs *Its* Internal Working Paper No. 50
(Grant NsG-243-62)
(NASA-CR-80089) CFSTI: HC $2.00/MF $0.50 CSCL 05K

Philosophical aspects of equilibrium systems from a dialectical or tensional point of view are considered. Components are listed for this system, which is defined as the very general system form of which feedback system and input-output system are special cases. The following concepts are mentioned in this connection: decision making, information theory, morphological function, and communication systems, also provided are some assumptions of an observational model for behavioral investigation. R.Li.

N67-12264*# Washington Univ., St. Louis, Mo. Dept. of Economics.
THE FEDERAL BUDGET AND THE OUTLOOK FOR DEFENSE SPENDING
Murray L. Weidenbaum Nov. 1966 23 p refs *Its* Working Paper No. 6610
(Grant NsG-342)
(NASA-CR-80116) CFSTI: HC $1.00/MF $0.50 CSCL 05A

The current economic impact of the Viet Nam military buildup on the economy as a whole and on the Federal budget are examined, and defense spending is projected for 1967. The past spending as a result of the Viet Nam commitment is reviewed, and differences from the Korean situation are pointed out. The shifts taking place in military spending are identified. It is concluded that the major portion of the impact on the economy of the current defense buildup has already been felt. It is expected that the inflationary pressures accompanying the expansion in defense spending may subside during the coming year and that expansion of nondefense spending may take place. N.E.N.

N67-12272*# California Univ., Berkeley. Space Sciences Lab.
HEGELIAN INQUIRING SYSTEM, CHAPTER VI
C. West Churchman Sep. 1966 46 p ref *Its* Internal Working Paper No. 49
(Grant NsG-243-62)
(NASA-CR-80117) CFSTI: HC $2.00/MF $0.50 CSCL 05F

A philosophical discussion is presented, emphasizing the objectivity of the inquirer or observer in acquiring information. The subjectivity syndrome and representations of observational behavior are reviewed. The working of the mind, and the nature of objectivity in mental processes are discussed. The possibility of applying mathematical information theory to describe the human brain is mentioned. The net benefit policy of teleological information is explored. Hegelian and Kantian dialectics are discussed with respect to acquiring and judging information. N.E.N.

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